LEARN TO STUDY READERS

TEACHERS' EDITION

BOOK FIVE - GRADE SIX

3 Billy Woodward

MANUAL OF DIRECTIONS

FOR THE

LEARN TO STUDY READERS
BOOK FIVE

BY

ERNEST HORN

PROFESSOR OF EDUCATION AND DIRECTOR OF THE
ELEMENTARY SCHOOL, STATE UNIVERSITY OF IOWA

MABEL SNEDAKER

EXTENSION SUPERVISOR FROM THE ELEMENTARY SCHOOL
STATE UNIVERSITY OF IOWA

AND

BESS GOODYKOONTZ

ASSISTANT PROFESSOR OF EDUCATION, UNIVERSITY OF PITTSBURGH

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BOOK FIVE'S READING PROGRAM

It is the purpose of this reader to teach pupils how to study. The exercises have been planned to give pupils control of the skills involved in silent reading of the study type. For this reason the exercises are based on selections that are informational in character and comparable in content to the material with which pupils must work in preparing geography, history, civics, and other content lessons, and they give training in the skills which should be used in preparing such lessons. The study habits developed through these exercises can be applied to the study of any content material.

The exercises are planned to develop, step by step, the knowledges and skills involved in any specific ability. For instance, the ability to outline is built up through such exercises as matching paragraph headings; choosing the best from several paragraph headings; making paragraph headings; matching, choosing, and making sectional headings; arranging steps in order; selecting the steps in a process; selecting topics; filling in sub-points in a skeleton outline when the paragraph heading is given; filling in a similar outline when the paragraph heading is omitted; and so on. The exercises talk directly to the pupils, so that many of them may be carried out as study exercises without further directions from the teacher.

The tests afford pupils a means of diagnosing their own difficulties and of measuring their progress, besides being in themselves valuable learning experiences. They also afford the teacher a means of measuring attainment with reference to specific objectives and of diagnosing individual and group difficulties.

As a continuation of the program of the Learn to Study Readers, this book aims to continue the emphasis on fundamental study attitudes, habits, and skills, and to initiate some further ones which particularly apply to the study needs of pupils of the fifth and sixth grades.

MANUAL OF DIRECTIONS

THE READING SKILLS AND HABITS OF STUDY BOOK FIVE AIMS TO DEVELOP AND TO GIVE PRACTICE IN USING

1. The abilities involved in understanding what is read
   a. Answering questions about what is read: pages 38, 43, 47, 59, 130, 146, 198, 222, 240, 319, 357, 359
   b. Following directions: pages 142, 210, 221, 245, 330, 408
   c. Proving a point: pages 144, 397
   d. Selecting definite items of information: pages 70, 159, 256, 271, 329
   e. Reading and interpreting a graph: pages 182, 330
   f. Defining words and phrases from context: pages 231, 265, 305, 361, 378
   g. Recognizing similar ideas: page 388
2. The abilities involved in organizing what is read
   a. Giving the main topic of a paragraph, or section: pages 48, 181, 334
   b. Classifying material into groups: pages 52, 141
   c. Making an outline: pages 66, 88, 111, 112, 161, 246, 268, 337
   d. Taking notes for a particular purpose: pages 94, 114, 290, 306
   e. Summarizing
      (1) Paragraphs, topics, whole selections: pages 194, 198, 202, 209, 280, 281, 282, 405
      (2) By pictures: pages 94, 239
      (3) By topics: pages 28, 243, 304, 360
      (4) By graphs: pages 330, 332
      (5) In answer to leading questions: pages 101, 119
   f. Filling in the supporting details when the main points are given: pages 111, 112, 268

g. Explaining by summarizing reasons: pages 131, 397
h. Arranging ideas in their right order: page 132
i. Selecting important points: pages 134, 178, 209
j. Selecting the main topic of a paragraph: page 156
k. Organizing material around a definite problem: pages 167, 212, 290, 291, 337, 360
l. Grouping material around certain topics: pages 180, 181
m. Supplementing ideas read with items of personal experience: page 253

3. The abilities needed in remembering what is read
a. Analysis of what is necessary in remembering: pages 13, 16
b. Practice in remembering: pages 19, 64, 111, 129, 186, 245, 268, 357, 405
c. Practice in organizing material in order to remember it: pages 28, 64

4. The abilities needed in locating information
a. Using an index: pages 29, 335, 336
b. Using alphabetical arrangement: page 55
c. Practice in the use of the dictionary: pages 361, 373, 378, 382
d. Reading a map: page 96
e. Reading a graph: pages 182, 306, 330
f. Skimming to locate answers to questions: 256, 319, 325, 329, 388

HOW THE LESSONS MAY BE USED

1. As training lessons, in which the teacher works with the pupils, showing them how to use a new kind of study skill. Such lessons are found on pages 13, 96, 161.

2. As practice lessons, in which the members of the class work alone, each pupil trying out his ability on an assignment, while the teacher works with another class or gives individual help. Such lessons are found on pages 290, 329, 361.

3. As group lessons, in which the teacher and the pupils work together. Such lessons are found on pages 55, 160, 187, 209.

USING A LESSON IN SEVERAL WAYS

Many of the lessons in this book may be used in a variety of ways to develop a number of different reading abilities. For instance, a single selection might be used in the following ways:

1. A timed silent-reading test with *yes* or *no* questions following the reading to measure pupils' rate and comprehension.
2. A speed lesson, the teacher giving one question at a time, the pupils racing to find answers to questions and reading the answers aloud.
3. A study assignment, the pupils reading and supplying the missing words in a completion exercise written on the blackboard, while the teacher works with another class.
4. A vocabulary lesson, the teacher and pupils listing difficult words and phrases which must be studied in the context and verified by using the dictionary.
5. A training lesson, in which the teacher works with the pupils on material that they have read before, showing them how to do some new kind of work that may be required of them as a study assignment the following day, such as making an outline, naming paragraphs, stating an important question for each paragraph, and so on.
6. A memory test, in which pupils try to recall the important points in a selection read some time before and then re-read the lesson to add to their list of important points.

The following specific assignments are given as an illustration of how one selection may be used in several ways:

Page 224. Coal-Tar Wonders

Lesson 1. Aim: *Comprehension, through testing pupils' understanding of important points in the lesson after they have read it as a timed test.* This lesson may be introduced by asking pupils if they know from what perfumes are made, of what material phonograph records are made, and from what moth balls are made. After the pupils have suggested materials, tell them that not only these articles but thousands of others are made from one material. Raise the problem "What is this material? What

things are made from it?" Pupils should then be told that the lesson "Coal-Tar Wonders" will answer these questions and that they are to read straight through the lesson as rapidly as they can understand what they read. As soon as all have finished the reading, there will be a test to see how well they have understood what they read.

All pupils should start at the same time. They should raise their hands as they finish. The teacher keeps a record of each pupil's time. Each pupil's rate in words per minute may then be estimated. There are 1200 words in the selection. If one pupil takes 4 minutes 35 seconds for reading, his rate is 262 words per minute.

$$\frac{1200}{275} \times 60 = \frac{72000}{275} = 262 \text{ words}$$

The following test may then be given, the pupils answering in writing and from memory:

1. From what does coal tar come?
2. How is coal tar made?
3. How many kinds of dyes are made from coal tar?
4. How are coal-tar products used as first-aid supplies?
5. How are coal-tar products used in war time?
6. What qualities make bakelite a useful material?
7. Name five uses of bakelite.
8. What building materials are improved by the addition of coal-tar products?
9. What is the difference between a beehive oven and a by-product oven?
10. How has coal tar made it possible for us to enjoy dyes and perfumes which we could not formerly have enjoyed?

This test should be checked and scored as a record of each pupil's achievement.

Lesson 2. Aim: *Organization, through selecting and classifying items of information.* There are many coal-tar wonders named in this article, too many to remember easily unless they are grouped in some way. Pupils may divide their papers into sections for products of various kinds:

medicines, dyes, antiseptics, disinfectants, explosives, extracts and perfumes, building materials, manufacturing materials, other products. They may then re-read the lesson rapidly, classifying "Coal-Tar Wonders" under these heads. These should be checked carefully by the class and credit given to those who made the longest correct lists.

Lesson 3. AIM: *Comprehension, through attention to difficult words and phrases on which the meaning depends.* See directions for exercise on page 231.

CONCRETE SUGGESTIONS FOR TEACHING EACH LESSON

Page 13. Do you Remember what you Read? AIM: *Remembrance, through an analysis of what remembering depends upon and how much is remembered from a single reading.* After an informal discussion of what pupils think they remember from reading a lesson once, the class should read to find an answer to the question given. They may then, with the teacher, sum up in outline form on the blackboard their answer to the question *Do we remember what we read?* The final summary would include these points: (1) We do not remember a great amount of material which we read only once. (2) How much we remember depends upon how hard the lesson is, upon how much we already know about it, and upon how well we can study. (3) Only about 80 per cent of what was perfectly learned on one day is remembered the next day. (4) After 5 days 50 per cent is remembered; after 14 days 33 per cent; after 30 days 25 per cent. This summary should lead to the conclusion that something should be done to help us to remember more than this small amount.

Page 16. How to Remember what you Read. AIM: *Remembrance, through an explanation of what is necessary in remembering.* This lesson gives a number of rules for remembering. Pupils are to read it through carefully, trying to understand and remember each of the rules. As soon as they have finished reading they

may close their books and try to write the rules. One very short statement of each rule should be enough. Explanations of the rules may be given orally. Correct the papers, close the books, and try a second time.

Page 19. Practice in Remembering. Page 21. More Dangerous than Dynamite. AIM: *Remembrance, through practice.* This lesson gives good training not only in remembering but also in reading and following directions. Three lessons may be made of this and the following sections:

1. **Pages 19–27, except rule 5, page 20.** Have the class read silently pages 19–20 and decide exactly what is to be done. They will see that in the following lesson they are to make a list of the important questions which each paragraph answers. At the close of the period each pupil should have such a list.

2. **Rule 5, page 20.** Rule 5 may take a second period. Pupils should use their lists of important questions previously made and follow the directions in rule 5 carefully. After the first half of the period the pupils may compare their lists of questions, deciding on the best questions for each paragraph. These should then be answered orally as a final test for the whole lesson.

3. **Page 28. What Boys and Girls can do to prevent Gasoline Explosions.** Pupils may make the three suggested headings on their papers and may then skim quickly through pages 21–27, jotting down safety suggestions under each head.

Page 29. How to use an Index. AIM: *Location of material, through practice in using the index.* This lesson goes one step further than the index lessons in previous books and explains the method of locating material through "cross references" (first paragraph), and the method of using a classified index (second paragraph). Pupils should try this lesson alone first, to see how accurately they can read and follow directions. Emphasize the necessity for doing exactly what the directions say. If the pupils

do this, they should have no trouble in doing the exercise on pages 32–33. The whole lesson should then be checked as a class exercise, the answers on pages 29, 30, and 32 being given orally.

Page 34. How we came to have Numbers. AIM: *Comprehension, through reading and answering detailed questions about what is read.* There are three separate sections here, each with its own exercise and each enough for one lesson. Pupils should read straight through a section once to get the story, then do the exercise.

Exercise 1, page 38. *A*, class exercise; *B*, individual exercise, pupils skimming and writing rapidly; *C*, individual exercise, to summarize the section.

Exercise 2, page 43. *A*, class exercise; *B*, individual work; *C*, either oral or written summary; *D*, class exercise.

Exercise 3, page 47. Individual skimming and recording answers. Let the class check to see how many each pupil answered correctly.

Page 48. Choosing Paragraph Headings. AIM: *Organization, through selecting and writing the best paragraph heading for each of the five paragraphs given.* Later pupils may tell why they chose each one.

Page 52. How Books are Spoiled. AIM: *Organization, through classifying ideas.* Pupils may do this exercise individually. If there is likely to be any misunderstanding in following the directions, teacher and pupils may read to the middle of page 53 and then plan together exactly how to do the exercise. The rest may then be done individually. The completed work should be as follows:

Keeping a book clean: 1–5–9–14–17

Marking the place in a book: 2–(3)–4–(9)–11

Keeping the binding in good shape: (2)–3–6–7–8–10–12–13–15–16. Nos. 2, 3, 9 may be placed in two lists. Count either place right.

Page 55. Dictionary Test Lesson on Locating Words. AIM: *Location of material, through practice in the skill necessary in locating words in a dictionary.* This lesson presupposes a knowledge of alphabetical arrangement and of the value of guide words in the dictionary. Each part of this test may be taken as a separate timed exercise. Before the timing begins the teacher and the class should examine each part together to see exactly what is to be done.

Page 57. Where our Lumber has come From. AIM: *Comprehension, through reading to answer detailed questions.* Teacher and pupils read through the first paragraph to find out what is to be done. Pupils then read silently. This may be done as a timed test, the teacher recording the time for each pupil as he finishes. There are 297 words. Pupils then write answers to the questions from memory. To check, answers may be given and proved by reading from the text.

Page 61. How to Care for a Cut. AIM: *Remembrance, through organizing the points to be remembered, followed by practice in remembering these points.* The teacher may introduce the lesson by discussing with the pupils accidents in which they received cuts. She may tell them that much of the soreness might have been prevented if the cuts had been properly cared for. The pupils read the lesson silently, then do the exercise on page 64. After they have completed their lists of rules, the teacher should check the briefness and accuracy of the rules before the pupils begin to memorize them; otherwise some may set themselves the needlessly difficult task of memorizing long and poorly stated rules. Asking different pupils to read their lists and calling attention to clear statements would be one economical way to administer this check.

With iodine and gauze bandaging borrowed from the nurse's medicine cabinet or brought from home, the pupils may demon-

strate how to care for a cut. If the teacher wishes, the use of patented solutions, such as "mercurochrome" and "zonite," may be demonstrated.

Page 66. Making an Outline. AIM: *Organization, through outlining material read.* Pupils may do this lesson individually, writing only the paragraph headings and subpoints for the four paragraphs. If they have difficulty in understanding directions, the pupils and the teacher may study together the sample outline and directions on page 67. The rest should be done individually.

Page 70. Reading aloud to Others. AIM: *Comprehension, through reading carefully in order to follow directions.* Pupils should read this lesson through, silently, gathering suggestions as to how to read aloud well. They may follow the reading with informal discussion, telling of occasions when they needed to be able to read aloud well, or they may tell of reading to which they enjoyed listening and may try to analyze this reading to see if it met the three requirements discussed in this lesson. At the close of the discussion the teacher should check to be sure that the pupils have the three rules clearly in mind for the next day's lesson. This may be done by following the directions on page 72.

Page 73. Across the Plains in 1846. AIM: *To give practice in applying the basic rules of oral reading.* The average reading period will not give the children time enough both to choose a part in the story and to prepare it adequately to read aloud. Probably two periods should be given to the preparation of this lesson. A like amount of time will probably be needed to give all the pupils a chance to read orally. A friendly spirit of constructive criticism will be an important factor in making the oral reading a success.

Page 88. Another Outline Lesson. AIM: *Organization, through practice in outlining.* Pupils may do this lesson individually. There may be a class discussion for two purposes: first, to check the papers and let each pupil know his score out of a possible

16 points; and secondly, to give pupils a chance to discuss the best wording for each point. They should be encouraged to give the subpoints in brief, exact form.

Page 89. A Fireman talks about Rubbish. AIM: *Organization, through selecting important ideas in a selection.* Arouse interest in this lesson by discussing the picture and the paragraph under it. What is rubbish? Pupils may then read through the material silently. This may be used as a timed lesson if so desired. If so used, Exercise 1 on page 94 may be used as the comprehension test, the pupils listing fire dangers from memory. If it is not used as a timed test, the pupils may skim back through the reading in making out the list called for.

Exercise 2 on page 94 will make use of the pupils' ingenuity in putting into picture form the ideas they gain from reading. Each poster should have a central idea.

Page 96. How to read a Map. AIM: *Location of material, through training in reading a map.* This should be done as a class exercise, the pupils reading silently until they come to some question or direction which requires a response. After these are finished, the test lesson on page 100 should be done individually and should serve to test the pupils' ability both to understand the previous explanation and to read a map.

Page 101. Our National Forests. AIM: *Organization, through selecting and summarizing material around main topics.* In a preliminary discussion pupils will probably be able to suggest some ways in which all forests are valuable. Read through the introductory paragraph on page 101 together, and make it plain that as pupils read silently they are to discover all the answers they can to the two main questions given. After this they should read straight through the article and should then, from memory, try to fill in the blank outline given on page 111. A perfect score is 19 points. Since another similar lesson follows this, the teacher

may wish to correct this paper herself as a definite measure of her pupils' comprehension after a single reading.

Page 112. Filling in an Outline. Aim: *Organization, through practice in selecting and stating the subpoints necessary to complete an outline.* Emphasis should be placed on the need for stating points in an outline in similar form; that is, all sentences or all phrases. This may be used as a study assignment.

Page 114. In a National Forest. Aim: *Organization, involved in reading new material on a subject already studied, for the purpose of evaluating and listing the new ideas presented.* Pupils may head their papers "New Ideas about the National Forests," and as they read they may write down very briefly the ideas found in this lesson which have not been met in the previous lesson. They should learn to read, decide, and jot down notes rapidly.

Page 119. Cork, a Useful Material. Page 120. Raw Cork. Aim: *Comprehension and organization, through selecting the material needed to answer the questions raised in the introduction.* After reading the introduction, the pupils will enjoy discussing the questions asked in the first paragraph. The teacher should call attention to the importance of having clearly in mind the questions raised in the introduction before beginning to read the lesson "Raw Cork." When the pupils have carried out the directions under "How Carefully did you Read?" on page 129, their work should be checked as a class exercise. In this check-up the pupils should not read the questions orally. They should answer the questions in complete statements; for example, "The cork oak is about twenty years old when the first bark is stripped off." Turn back to the text and verify statements about which pupils disagree.

It will add much to the interest with which all the lessons about cork are read if the pupils are encouraged to bring into the school-

room articles made of cork and to make charts showing "Uses of Cork," "Uses of Cork Waste," etc. These charts may be made outside of school hours or in spare time.

Page 131. Can you tell why These Things are made of Cork? AIM: *Comprehension and evaluation, through choosing a correct reason from among a number of reasons.* Before giving reasons for the thirteen uses of cork, the pupils may discuss and list the qualities of cork given on page 122.

Page 132. Arranging the Steps in a Process in Order. AIM: *Organization, through arranging points in order in one type of outline form.* To make sure that the pupils understand the directions, the teacher should discuss with them the first two paragraphs of this exercise. She may supplement the explanation by pointing out the arrangement of steps in some process which the pupils have studied recently; for example,

Steps in preparing a field for planting
- Plowing the ground
- Harrowing the ground
- Etc.

After the pupils understand the directions, they should work independently in carrying them out. The work should be checked as a class exercise, the teacher writing out the steps on the board as the pupils give the numbers in order. She should point out the fact that the work on the board is an outline of the main points under the topic "Preparing Raw Cork for Shipment."

When the exercise has been checked, pupils may test their memory of points concerning the question How is raw cork prepared for use? by describing each step in detail. One child may be chosen to report on each topic.

Page 134. Selecting the Steps in a Process. Page 135. How Bottle Stoppers are Made. AIM: *Organization, through analyz-*

ing a process into consecutive steps. The teacher should discuss the directions with the pupils, calling attention to instances in geography, language, and other subjects in which selecting the steps in a process would be an aid in giving a good report. To make sure that the pupils understand about keeping all the steps in the same form, the teacher may write on the blackboard in a number of ways the first step from the outline "How sugar cane is grown and harvested in the Sugar Islands." In addition to the ways given in the book, the first step might be written "Fields prepared for planting," or "To prepare fields for planting," and so on. In each case the pupils should then state the succeeding steps in the same form as the first step. After the pupils understand the directions clearly, they should work independently in selecting and writing out the steps through which cork bark passes in being made into bottle stoppers. The completed outlines may first be checked as a class exercise, and then one or more pupils may be chosen to give a report, using the outline as a basis.

Page 139. Cork Waste. Aim: *Organization, through classifying information.* After the headings have been copied on a sheet of paper, the books should be closed while the exercise on page 141 is done.

Page 142. Making a Graph. Aim: *Comprehension, through reading, understanding, and following directions.* Pupils may recall graphs which they have seen and what such graphs were for. They may then attempt the lesson on page 142, reading silently and following the directions very carefully. At the end of the period each pupil should have two bar graphs done correctly to illustrate the two statements given.

The additional statements at the bottom of page 143 may be given to the class on the following day for additional practice if the teacher wishes. Others from their own geography lessons may be added.

Page 144. Proving your Answer. Aim: *Comprehension, through finding exact words to prove answers to questions.* It is often necessary in other subjects to prove one's point of view with direct quotations from the text. This lesson offers an opportunity to do this. Emphasis should be placed on the need for giving only those words necessary for proof. For an individual lesson this should be written; for a class exercise the proof for each answer may be read orally.

Page 146. Do you know the Answers? Page 148. The Story of Dyes. Aim: *Comprehension, through reading an article guided by definite questions.* The teacher might introduce this lesson by taking a vote among the pupils as to their favorite color, by pointing out different colors and shades of one color in clothing, books, and other objects in the room, by asking the pupils if they know whether or not it has always been possible to dye clothing the same colors that we dye our clothing today, and by asking what a fast color is.

Before beginning the reading of "The Story of Dyes," allow the pupils an opportunity to talk about any questions in the introduction that they do not understand. They may need help with the pronunciation of "Tyrian" and "aniline." Write the words "Egyptians," "Romans," and "mummies" on the blackboard, and explain them if the pupils cannot do so.

In the check-up for this lesson the questions should be answered orally as a class exercise. At this time the class should answer the question under the illustration on page 152. It would be interesting to bring into the schoolroom as many natural dyestuffs, such as red oak and hickory bark, pokeberries, and walnut hulls, as can be collected, together with pictures of natural dyestuffs which cannot be readily obtained.

Page 156. Matching Paragraph Headings. Aim: *Organization, through practice in recognizing the topic of each paragraph*

read. In this lesson pupils should be able to tell which topic or paragraph heading belongs with each paragraph of the lesson on "Our National Forests." They should read the directions on page 156 and then turn back to "Our National Forests" and follow the directions carefully. After all have finished, the papers should be checked. Correct answers: 1.*g*; 2.*b*; 3.*i*; 4.*d*; 5.*f*; 6.*l*; 7.*c*; 8.*h*; 9.*a*; 10.*j*; 11.*e*; 12.*m*; 13.*k*.

Page 157. Using New Words in New Ways. Aim: *Comprehension, through studying the meaning of a word from its context.* We more often get the meaning of a new word from the way it is used than from looking it up in the dictionary. This exercise is designed to give practice in such skill. Each difficult word or phrase should be located in the lesson called "A Fireman talks about Rubbish," and it should be defined as it is used. The new sentences should then be given by members of the class.

Page 158. How to Treat a Bruise. Aim: *Comprehension, through summing up the main ideas in a completion test.* Test I should be written without referring to the lesson. When the sentences are checked, the pupils should verify statements about which there is disagreement by turning back to the text. In most schoolrooms cold water will of necessity be used for the demonstration called for in Test II.

Page 161. Making a Long Outline. Aim: *Organization, through training in outlining.* This outline goes one step further than the previous lessons in outlining. The first part of this lesson, pages 161–164, should be a class exercise, the pupils reading silently and stopping when there is a question for discussion. When this first part is finished, the pupils' individual understanding of the work may be tested in doing the two similar outlines on pages 164–166. These should be checked as a class exercise.

Page 167. A Great Frenchman. Aim: *Organization, through selecting and listing the important ideas from a selection.* The

teacher might introduce this lesson by allowing the pupils to vote for the American who they think has done the most good for his country. They should point out specific services to the country as a reason for their choice.

In the check-up which follows the writing of the test, the pupils should tell why the discoveries they marked with an X are important to all the world.

Page 178. Learning to divide Material by Means of Sectional Headings. AIM: *Organization, through grouping related paragraphs under a topic.* Before dividing the lesson "A Great Frenchman" into sections with sectional headings, the pupils should note sectional headings in their geographies and other texts. One of these sectional headings may be written on the blackboard and the paragraphs under it numbered according to the directions for this exercise.

Page 180. Learning to divide Material by Means of Marginal Headings. AIM: *Organization, through grouping related paragraphs under a topic.* Before doing this exercise the pupils should find marginal headings in several books, noticing the variety of ways in which such headings are stated. They may try restating some of these headings in different forms.

Page 181. Making Marginal Headings. AIM: *Organization, through choosing marginal headings.* In checking this exercise the pupils will be able to judge the merit of the suggested headings more clearly if the best of these are written on the board.

Page 182. How to Read a Graph. AIM: *Comprehension, through reading and understanding ideas presented in graphic form.* After the pupils have read the lesson silently, the questions on page 185 should be reviewed as a group exercise before the test is begun. The second part of the test may be given as an individual exercise, or groups of pupils may work together in making a graph.

Barred paper will be an aid to pupils who are inexperienced in making graphs of this type. Some pupils will not be able to do the second part of the test independently. They will need help, first, in deciding what the two rows of figures on their graph are to represent; secondly, in deciding upon the quantities to set down at the side and the bottom of the graph, particularly if one row reads 1, 2, 3, 4, 5, and the other 5, 10, 15, 20, 25, as in the graph on page 184.

Attention should be called to the growing need for being able to read graphs by pointing out the increased use of graphs in recent books, the use of graphs in advertisements, etc. The pupils will enjoy making a collection of such advertisements.

Page 186. Practice in Remembering. Aim: *Remembrance, through practice.* The pupil should write as many rules as he can remember, then turn his paper over and write on the back of the sheet the rules for which he has to refer to the text.

Page 187. What is a Good Summary? Aim: *Organization, through practice in summarizing the main points of a paragraph.* Since this exercise talks directly to the pupils and gives its own directions, it will not be necessary to explain or to give further directions. Pupils may be asked to read carefully, doing exactly what the lesson directs, and answering in written form the questions in the last three lines on page 189.

The second summary sentence is the best.

Additional lessons of this kind, using paragraphs from other textbooks, may be made to give further training in this important reading ability.

Page 190. The Story of how Man has left Records. Part I. Early Forms of Communication. Aim: *Organization, through practice in making summary sentences for paragraphs.* As a preliminary the class may tell what they know about the reasons why ancient people wished to send messages, why they wanted to

make records, how the Indians of our country sent messages, and other facts about the earliest kinds of writing. The pupils may then read straight through this section, with the purpose in mind of finding additional information about the subject. After an informal summary the exercises on page 194 should be done. The first may be done as a class exercise, the pupils reading silently each paragraph and giving their best suggestions for summary sentences to be written on the board by the teacher and judged by the class; the second may be done as individual work, to create interest and give a chance for originality.

Part II. How we got our Alphabet. AIM: *Organization, through learning to make a summary paragraph of a selection.* The class may read straight through this section (as a timed test if the teacher wishes) and may then informally test their understanding of the section by asking one another questions. After this, each pupil should write the answers to the questions on page 198, looking back through the selection to be sure of the right information. The answers will make a good summary paragraph.

Part III. From Stone to Paper. AIM: *Organization, through summarizing all the information about topics.* Pupils should be able to explain the title. They should read straight through this section, having in mind this problem: to be able to trace in definite steps the development of materials from stone to paper. After the reading, the class as a whole may outline the section, listing the stages of progress described. When this is finished, each pupil should prepare to explain one of the topics suggested at the end of the section.

Part IV. Development of Printing. AIM: *Organization, through practice in selecting main points of a selection to use as the basis of a summary discussion.* The class may read through this section silently, trying to formulate a series of steps in the development

of printing. After the reading, the pupils' ideas of what these developing steps are may be explained and compared. The pupils should then do the concluding exercise on page 209 individually. The main points will be somewhat like these: (1) hand-made books; (2) earliest use of type; (3) forms of block printing; (4) Johann Gutenberg's invention of printing; (5) later inventions in printing machinery; (6) modern improvements in printing presses. If possible a summary account of the whole story of how man has left records might be given by a selected group as a class report, as an assembly report, or as a courtesy report in some other classroom.

Page 210. How to show Answers on a Map. Aim: *Comprehension, through reading carefully in order to follow directions.* When the maps for this lesson are finished and each pupil has found the lesson on "Where our Lumber has come From," he should read the first direction, marked "1," should read to find the specific answer, and should then locate that answer on the map as directed. As a class exercise, the answer to each question may be given and placed on a large blackboard map, while each pupil checks his own paper. Thirteen is a perfect score.

Page 212. Making the Atmosphere Work. Page 221. Some Experiments for you to Do. Aim: *Comprehension and organization, through following detailed directions accurately and arranging an explanation according to a specified plan.* This lesson will take several periods. After the lesson has been read and each pupil has chosen one of the statements on page 222, he may skim the lesson to choose his experiment. A list of the experiments chosen should be made for the purpose of seeing that they are somewhat equally distributed among the group. At the end of the preparation period pupils choosing the same experiment may plan coöperatively for securing the materials and performing the experiment. They may appoint one pupil from their group to per-

form the experiment, the others acting as judges, or they may assign different parts of the work to different pupils. It will add much to the interest if some are able to report experiments other than those described in the lesson. These may be chosen from various science books.

Page 222. Questions and a Problem. AIM: *Comprehension, through answering questions and solving a problem which test the pupils' understanding of the experiments performed.* The questions may be answered orally as a class exercise.

The problem. We do not feel the weight of the air because the pressure of the air inside the body is as great as that on the outside of the body. Pressure on the inside of the eardrum is kept equal to that on the outside by means of the eustachian tube. If a person were shot rapidly from the basement of the Woolworth Building to the top, he would feel uncomfortable for a few moments because of the lack of adjustment between the air pressure outside and inside the body.

Page 224. Coal-Tar Wonders. Page 231. Can you Explain These? AIM: *Comprehension, through explaining words and phrases on which the meaning of the selection depends.* Introduce the lesson by examination and discussion of the picture on page 225. After the lesson has been read silently, the pupils may be given a few minutes in which to think of clear explanations for the words and phrases listed in the exercise on page 231, referring to the lesson if necessary. The check may be (1) an oral class exercise, different pupils trying the explanation of each term until the class agree upon one as thoroughly satisfactory, or (2) a written test, later checked as a class exercise. This lesson may be done as a timed test. There are 1200 words.

Additional exercises which may be used in connection with this lesson are described on page 3 of the Manual.

Page 232. The Care of the Feet. Page 234. Shoes and

Health. Page 239. Illustrating a Talk with Outline Drawings. AIM: *Organization, through selecting and arranging information around a topic.* After an informal discussion of the introduction the pupils should read straight through the lesson "Shoes and Health" to find the answer to the question raised. They should then carry out the directions given in the exercise on page 239, keeping in mind the fact that they are to select all the information which might help to make their explanations clear, not merely that given on pages 238–239. If the pupils have difficulty in understanding how the outline drawings are to be used, let one pupil demonstrate how he would use the outline drawings on page 239 to illustrate a talk on "The width of shoes." This lesson will probably take two reading periods.

After having heard the illustrated talks, the class should be able to make a good score on the memory test on page 240. This may be written or given orally as a class exercise.

Page 241. Aids to Foot Comfort. AIM: *Organization, by selecting and arranging information around topics.* Each pupil should be responsible for all the topics, so that he can report to the class on any topic for which he may be asked. Pupils should demonstrate the correct way to walk. Reports on the methods of caring for the feet and of walking used by veteran walkers will interest the class. *The Saturday Evening Post* of July 31, 1926, contains an article about Edward Payson Weston, the veteran long-distance walker.

Page 244. Exercises for the Feet. AIM: *Comprehension, through reading, understanding, and following directions.* Exercises 1, 2, 3, and 6 may be done in the schoolroom without removing the shoes; exercise 4 can be done by a pupil who is wearing tennis shoes. The pupils should be encouraged to find out other good exercises for strengthening the feet and to do these exercises frequently during gymnasium or rest periods.

Page 246. A Test of your Ability to outline a Lesson. Page 248. The Uses of Corn. Part I. Aim : *Organization, through practice in outlining.* Two new skills are introduced in this lesson: first, the use of the four-step outline; secondly, the making of an outline without the aid of a blank outline form. For this reason the test is based on material similar to that used in the lesson "Making a Long Outline." The pupils should first read to the bottom of page 246 to find out what they are to do. Several may be asked to put the outline form on the blackboard. When the directions are clearly understood, each should work independently in writing the outline. The work should be corrected as a class exercise to give the pupils a chance to discuss the best arrangement of points.

The section "*B*. From the white body of the corn" under "I. Products made from the kernel," corresponding to "*A*. From the germ," may be developed into a five-point outline by including the uses of the various products of starch. The points which this section should include in a four-step outline are as follows:

I. Products made from the kernel

. . . .

B. From the white body of the corn
1. Starch whose products are
   a. Cornstarch (used for cooking)
   b. Laundry starch
   c. A starch used in the textile industries
   d. A starch used in the paper industry
   e. Dextrin
   f. Glucose
   g. Corn sugar
   h. Nitro-starch
   i. Alcohol

If the teacher wishes to teach the five-step outline, she may devote another lesson to filling in the uses of each of the products of starch, as in the example which follows:

e. Dextrin used
  (1) As a mucilage on stamps and envelopes
  (2) In the manufacture of sparklers

Products made from other parts of the corn will follow in the outline as II, III, etc.

Page 253. Test. Aim: *Remembrance, through classifying information from memory.* The pupils should classify the articles without referring to the lesson. The papers may be exchanged and corrected as a class exercise.

Page 254. Making an Outline from Memory. Page 254. The Uses of Corn. Part II. Aim: *Organization and remembrance, through making an outline from memory.* The pupils should carry out the directions without help. The lesson may be done as a study exercise while the teacher hears another class or is busy with other work. It should be checked as a class exercise.

Page 255. Learning to make a Summary from an Outline. Aim: *Organization, by stating the points in an outline in summary sentences.* The pupils should have their written outlines before them while making these summaries. This exercise may be combined with the preceding exercise as part of a study lesson, both being checked at the same time by the class. A number of the summary sentences suggested may be written on the board, the class deciding which are best by the standard of the three points for judging a summary.

Page 255. Selecting Headings and Topics. Aim: *Organization, through dividing a lesson into sections and listing the topics included under each section.* The pupils should be able to carry out the directions without further explanation. The work may be

checked as a class exercise. The lesson may be divided into four sections. The following are suggested as headings for Parts III and IV: Part III. "Dyes used by the Colonial Housewife in America"; Part IV. "The Aniline Dyes used in the Modern Factory."

Page 256. Do you know the Answers? AIM: *Comprehension, through reading an article guided by definite questions.* At the beginning of the period pupils may read this list of questions silently to see how many they can answer, but none of the questions should be answered. After reading, pupils will turn back to page 256 and answer each question. This may be done (1) by having the question read and answered orally; (2) by having the question read, the answer given, and the proof supplied by reading from the text; or (3) by having each pupil write his answers for the questions as an individual test of comprehension.

Page 265. Giving Meanings of Words without a Dictionary. AIM: *Comprehension, through attention to exact meanings of words in a selection.* This is another lesson in defining words from their context. The class should read the explanation of this lesson silently and may then do the exercise as directed. When all have finished, the correct answers should be given and the papers checked. Proof may be given from the text in case of argument. The correct answers are 1.*c*; 2.*a*; 3.*b*; 4.*b*; 5.*a*; 6.*c*; 7.*a*; 8.*c*; 9.*b*; 10.*a*; 11.*b*; 12.*a*.

Page 268. Filling in a Skeleton Outline. AIM: *Organization, through supplying the points to complete a skeleton outline.* Before the pupils do this exercise individually, it would be well for the teacher to read with them the main headings in the outline, letting them suggest, from memory, points which should be included. After this preliminary work the pupils should make out the complete outline on their own papers, looking up all

doubtful points in their texts, pages 257–264. A class outline may be made on the blackboard by which they may judge their own papers. Forty-eight points is a perfect score.

Page 271. Proving an Explanation to be Right. Page 272. The Birds' Compass. Part I. AIM: *Organization, through selecting and arranging material in answer to certain definite questions.* The teacher and pupils should read and discuss together the directions on page 271. Pupils may be able to relate instances in which they needed to prove explanations when there was no evidence to be found in books. They should have clearly in mind the method described and the questions which are to guide their reading before they begin reading "The Birds' Compass." The work is not to be written. As soon as each child has finished reading, he should begin work on the test. He may write this in outline form and later check it with the class, or he may jot down only the points needed to assist him in giving a report before the class. If the latter plan is used, several pupils may give reports in turn, the class deciding upon the most convincing report.

Page 281. A Report to Make. AIM: *Organization, through selecting and arranging points in order.* The name of the book, "The Travels of Birds," by Frank M. Chapman, is found in the Preface to the reader. The children should be encouraged to read this book as a leisure-time activity. Individual pupils may prepare reports from the book to make to the class, or the class may read chapters from the book at sight, passing the book from pupil to pupil. They may follow the reading by planning possible reports. The method described in the preceding lesson cannot be applied to many of the chapters in "The Travels of Birds."

Page 282. How Accurately can you report an Experiment? Page 283. The Birds' Compass. Part II. AIM: *Organization, through selecting points accurately and arranging them in order.* The pupil should prepare his report without help, jotting down

notes to guide him in planning his talk, if he likes. However, he should give the report without notes. The class should use the outline on page 282 as a basis for judging the clearness and accuracy of the talks.

Page 290. Note-Taking in a Problem Assignment. Aim: *Organization, through training in selecting points in answer to a problem and putting them down as notes for reference.* Since this exercise talks directly to the pupils, they should be allowed to do it silently and without help. Their ability to have eight correct points listed in answer to the problem will be an indication of their ability to read and follow directions. There should be a class check, the points being given and written on the board. Points to be listed: New England has cheap water power, is close to coal fields, has good transportation facilities, a moist climate, enough labor, skillful workers, a reputation, and an early start.

Page 293. The Story of Oil. Aim: *Organization, through setting up definite problems before reading an article and trying to secure well-organized answers to them while reading.* Before reading, pupils may suggest, as a guide in their reading, such questions as Where does the oil come from? How much do we have? How was it found? How is it discovered? How is it used? etc. After the pupils have read the lesson silently, they may answer in good form as many of their own problems as they found answers for. This will serve as a preliminary for the summary reports of the topics listed on page 291, which may be given as individual oral reports or as written summaries for this lesson.

Page 305. How Well did you understand the Words in this Lesson? Aim: *Comprehension, through attention to exact meanings of words in a selection.* This may be done as a class exercise, each word or phrase being defined in turn. If desired, the words might be used as the basis of a skimming lesson, pupils racing to find each word or phrase as it is given by the teacher, and the first

one to locate it defining it. Or these words and phrases, with additional ones from the text, might be used as the list for a "spell-down" exercise, each pupil in turn defining the word or phrase pronounced to him.

Page 306. Another Lesson in Taking Notes. AIM: *Organization, through practice in taking notes of points to be used in solving a problem.* This lesson should be used as a class exercise up to the point where the problem is stated and pupils are ready to take notes. The map and the chart should be studied carefully, and the conclusion drawn from them that the Southern states have made remarkable progress in the manufacture of cotton cloth. After the problem is stated and copied by the pupils on their papers, the class may read silently, taking down points which help to solve the problem. When all have finished, a class summary may be made on the blackboard, using the best points suggested by pupils. These should be given: (1) The mills of the Southern states are near the cotton fields; (2) Cheap water power is produced along the fall line; (3) Alabama has rich coal fields; (4) There is plenty of labor.

Page 310. Speed on Land. Page 319. How Well can you Find and Use Numbers? AIM: *Comprehension, through finding, reading, and using numerical statements.* Boys and girls are always interested in knowing how fast things can go. They should be allowed to tell what they know of fast rates of travel. They may know how fast some cars can go, or perhaps some running records. It is not the purpose of this lesson to have pupils try to remember a great many numbers, but they should be able to read and understand numerical statements. After the discussion the pupils will read silently the section "Speed on Land" with the purpose of finding out what are the record speeds of travel on land and how they were made. After the reading, they should answer in writing the questions following the selection. The cor-

rect answers follow: (1) 150 miles in three days; (2) 6 min. $25\frac{4}{5}$ sec.; (3) (*a*) 4 min. $10\frac{2}{5}$ sec.; (*b*) 2 min. $15\frac{2}{5}$ sec.; (4) walked in an hour 8 mi. 438 yd.; run in an hour 11 mi. 442 yd.; (5) (*a*) 2 min. 35 sec.; (*b*) 1 min. $35\frac{2}{5}$ sec.; (6) (*a*) 1 min. $35\frac{2}{5}$ sec.; (*b*) faster; (7) running horse; (8) 1 min. 51 sec.—1 min. $4\frac{1}{5}$ sec. $= 46\frac{4}{5}$ sec. gained; (9) the record for walking; (10) (*a*) the automobile; (*b*) the automobile; (11) (*a*) fatigue lowers the rate; (*b*) the skating record for 1 mi. is 2 min. 35 sec. The skating record for 10 mi. is 31 min. $7\frac{1}{2}$ sec.

Page 321. Speed in the Water and in the Air. Page 329. A Skimming Exercise. AIM: *Comprehension, through finding, reading, and using numerical statements.* Before starting this lesson pupils may review what they remember about speed on land. (What is the slowest way to travel? What is the next faster way? and so on. What travels fastest?) What do pupils know about speed records in the water and in the air? What do they think travels fastest in each place? Is this as fast as a racing automobile can go? After this discussion, pupils may read straight through this section, with the problems given above in mind. When they have finished reading, a discussion should bring out the fastest speeds given in this section. Then they should do the exercise on page 329, writing only the answers.

Correct answers: (1) 22 min. 24 sec.; (2) 18 miles; faster; (3) 30 miles; (4) two times; (5) 266.59 miles; four times; (6) from 10 to 20 miles; (7) 800 miles; (8) 186,600 miles.

Page 330. Making Graphs to compare Speeds. AIM: *Organization, through arranging material in graphic form.* Pupils should examine carefully the graph on page 330, which shows how to collect and record speeds on land. When this is understood, pupils should turn to the next exercise and collect the records for travel in the water and in the air. These records are stated in terms of miles per hour. No other records should be included.

When the records are ready, each pupil should make his own graph, following the directions given.

No. 3 may be used as a separate, final exercise for a summary of the whole selection. Pupils will first answer the five questions given, thus preparing their figures. Then following the directions, they may make the graph which compares all fastest rates of travel—on land, in the water, in the air. In conclusion the final questions should be answered.

Page 332. More Things to do with the Speed Lesson. Aim: *Organization, through practice in selecting and arranging information for solving a problem.* When interest in rates of speed is already high, it would be a good thing for the class to hold an informal track meet for the purpose of comparing their own speeds with the records given. No. 2 may be done orally from memory. The ten assignments under 3 may be read through by the class, with a discussion as to how each one may be done. A certain time (fifteen minutes) may then be allowed for making these graphs. If they can be done on the blackboard and explained to the class, more interest and information will be derived.

Page 334. What does Each Paragraph Tell? Aim: *Organization, through naming the topic of each paragraph of a selection.* The class may read through the directions for this exercise and then do the exercise individually. The completion of the exercise should be followed by class discussion for the purpose of deciding on the best statements of topics and for the checking of pupils' papers.

Page 335. An Index Lesson. Aim: *Location of material, through practice in using the index.* The directions for this exercise may be read silently and summarized aloud for the purpose of making sure that everyone knows exactly what to do. Pupils may then race to find the answers to the seven questions, writing each answer as briefly as possible and the number of the page on

which it is found. The answers may then be given aloud and the proof read from the text.

Page 336. Index Drill with Series of Questions. Aim: *Location of material, through practice in using the index to find answers to questions.* The class should review the steps to be followed in this kind of exercise. They may then race to find answers to the questions as they did before.

Page 337. What the Eskimos get from Seals. Aim: *Organization, through outlining a selection.* Pupils will like to examine the picture on page 337 and read from it all they can about seals. They may wish to look up other pictures to find out more about how a seal looks, how it lives, and so on. The class may then read through the introduction on page 337, discovering that the problem to keep in mind while reading is What do the Eskimos get from seals? They may then read straight through the selection, remembering the main items. After this they should read again, making an outline as they read. The outline should include five main points (food, fuel, clothing, shelter, boats) with subpoints under each.

Page 344. Early American Methods of Transportation. Aim: *Organization, through reading to select points bearing on problems.* Follow the reading of the introductory paragraphs of this lesson by informal discussion, allowing pupils to tell the parts of the world from which foods come to them and how, to point out on the map the routes of vacation journeys, and to tell the means of transportation used. Contrast the speed and comfort of travel and transportation today with what the pupils know of travel in pioneer days. Make it clear that they are to find *all the facts they can* about the two questions. This may be a timed test, the teacher recording the time for each pupil as he finishes. If the lesson is used as a timed test, the teacher should ask each pupil to read straight through the lesson once, looking back for additional

points after his score has been recorded. There are 1860 words in the selection, beginning with "Travel was far more . . ."

1. A Test of your Memory of Main Points. AIM: *Remembrance, through answering questions covering the main points of a selection.* The pupils should be able to follow the directions for the test without further explanation. Allow ten minutes for the test. The work should be checked as a class exercise.

2. How Many of These Detailed Questions can you Answer? AIM: *Remembrance, through answering questions covering detailed points of a selection.* This test may be given immediately after the preceding test, both being checked later as a class exercise. It may be a timed test (eight minutes). In this case ask the pupils to hand in their papers or put them away before referring back to the lesson.

3. A Test of your Ability to explain Clearly how Something is Made. AIM: *Organization, through selecting steps of a process in sequence.* These reports should be given orally, several pupils making each report and the rest of the class helping with constructive criticism.

Page 361. Finding the Meanings of Words. Page 365. With Army Ants "Somewhere" in the Jungle. Part I. In the Pit. AIM: *Location of material, through practice in using the dictionary to find good definitions for words.* This lesson also gives training in comprehension and evaluation in choosing definitions that fit the context. Since this exercise talks directly to the child and gives its own directions, it may be done as a study exercise. There should be class discussion after the completion of the work for the purpose of deciding on the best definitions and for the checking of the children's papers. A list of all words whose meaning any pupil knew from the context may be written on the blackboard. Call attention to the fact that the list of words whose meaning it was necessary to look up in the dictionary was not the

same for each child. When the exercise has been completed, the children may read silently for enjoyment "With Army Ants." Part I.

After reading this lesson, the class will enjoy finding pictures of army ants and more information about them.

Page 373. Choosing Words for Dictionary Study. Page 374. With Army Ants "Somewhere" in the Jungle. Part II. On the Trail. AIM: *Location of material, through finding words in the dictionary and choosing proper definitions for them.* This lesson may be done as a study exercise. The children should work independently. As each child finishes his list he should hand his paper to the teacher or put it away. He may then begin work on the test on page 378. The test should be checked as a class exercise in order to allow pupils to compare definitions. Make a list on the blackboard of words not included in the test, which pupils looked up in the dictionary. Let the pupils point out the words in the test whose meaning they were able to get from the context without using the dictionary. Emphasize the fact that the pupil himself should decide which words in a lesson he needs to look up in the dictionary.

Page 379. The Birds' Worst Enemy. Part I. Page 382. Dictionary Lesson. AIM: *Comprehension, through practice in defining difficult phrases on which the meaning of a selection depends.* Pupils may read Part I with the idea of finding out what the birds' worst enemy is and how it is worse than other enemies. After the reading they should summarize this section. After the summary they should do as a class exercise the exercise which follows the section, each pupil looking up the words which puzzle him and preparing his explanations.

Page 383. The Birds' Worst Enemy. Part II. Page 388. Finding Matching Statements. AIM: *Comprehension, through evaluating statements and matching statements of like meaning.* Pupils should read the first paragraph on page 383 to see that

Part II will give evidence to prove that the cat is the birds' worst enemy. They may then arrange a sheet of paper on which to take notes in this way:

Authorities who say that cats are the birds'

WORST ENEMY	SERIOUS ENEMY
1.	1.
2.	2.
3.	3.

As the pupils read they will evaluate the opinion of each authority and place the person's name in the proper column. When this is done and the conclusions have been drawn, the question Why are the opinions of these people important? should be raised. Pupils may then skim to find in the section the items of information about the persons quoted to show why they are authorities on this subject.

As a second lesson, the exercise in matching sentences of like meaning given on page 388 may be done by pupils individually, following the directions as given.

Page 390. How to keep Cats from killing Birds. AIM: *Organization, through reading with definite problems in mind.* When pupils have finished reading, they may test their ability to select and remember points in answer to a problem by writing down quickly as many suggestions as they can remember. After this they should skim through the lesson rapidly, finding other points to add to their lists.

Page 397. Exercise 1. AIM: *Comprehension, through quoting authority for a statement.* This may be done as a class exercise, making use of oral reading for supplying proof.

Exercise 2. AIM: *Organization, through outlining a lesson which has a definite problem organization.* This may be done individually as another test of pupils' ability to outline.

Page 398. How to keep Mail from being Lost. AIM: *Organization, through selecting and summarizing in answer to a problem.* The class may read through the "Do you Know" paragraph at the beginning of this lesson in order to get the problem well in mind. They may be able to relate instances in which lost mail has caused great sorrow or inconvenience. As they read, they should try to find all practical suggestions for avoiding losing mail. This reading may be used as a timed test. After the reading, pupils should try the memory test at the end of the lesson. This will be corrected by making a composite class list.

Page 406. What is Wrong on These Envelopes? AIM: *Organization, through applying certain standards to a finished piece of work and summarizing the defects of the work according to the standards.* Pupils should first review the correct form of address and the reasons that many letters are lost, and should then summarize for each addressed envelope the items which are incorrect.

Page 408. How to Address an Envelope Correctly. AIM: *Comprehension, through practice in following specific directions.* This exercise may be considered a practical application of the knowledge secured in the previous lesson. Pupils should examine carefully the model addressed envelope, and should then address those suggested in the exercise. These may be exchanged for correction.

THE KINDS OF SUBJECT MATTER INCLUDED IN BOOK FIVE

Health and Safety

Citizenship, Social Relationships, Thrift

THE LEARN TO STUDY READERS

BOOK FIVE – GRADE SIX

BY

ERNEST HORN

Professor of Education and Director of the Elementary School, State University of Iowa

MABEL SNEDAKER

Extension Supervisor from the Elementary School, State University of Iowa

AND

BESS GOODYKOONTZ

Assistant Professor of Education University of Pittsburgh

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PREFACE

It is the purpose of this reader to teach pupils how to study. As one of the three R's, reading has always been regarded as a fundamental tool subject, and yet the abilities involved in the use of reading as an instrument have not always been clearly defined. There are four important classes of abilities needed in such study as is done with books.

1. There are those abilities needed in locating information. This involves skill in using the dictionary, in using the index, in using the table of contents, in using libraries and general reference books, and in skimming to locate information.

2. There are those abilities involved in accurately comprehending what is read, in selecting items for one's purpose, and in appraising the value of these items.

3. There are those abilities involved in organizing the data so understood and selected, according to the purposes for which one is reading at the time.

4. There are those abilities needed in providing for remembering what has been read.

First Lessons and Book One, with their manuals, include exercises for the development of all these abilities, but emphasize the second group especially. Book Two, while continuing to give the chief emphasis to the development of accurate comprehension, begins to put considerable stress upon the development of each of the other classes of abilities.

Book Three, while not lessening the emphasis upon accurate thought-getting, introduces somewhat more difficult exercises in locating information, in organizing what is read, and in developing the ability to remember what has been read. Particular stress is given in Book Three to the various abilities involved in evaluating what is read and in selecting and organizing data according to the purpose for which the material is read.

Book Four develops still further the abilities stressed in Book Three and emphasizes to a still greater extent those abilities involved in using reference materials.

Book Five builds upon the abilities developed in "First Lessons" and in Books One to Four of this series. It stresses and perfects especially those abilities involved in evaluating, organizing, and remembering what is read. The pupil who learns to do skillfully the exercises in this book should have an ability to study which is superior to that possessed by most junior-high-school pupils.

Since the purpose of this book is to teach pupils how to study, the selections included in it should exemplify the hard-work type of reading. This means that they should be informational in character. Such subject matter stimulates accurate thinking. It is easy to test the success with which such selections have been read.

The authors wish to make it plain that these readers are not meant to crowd out literary readers. Training in the appreciation of good literature should be provided in any well-rounded reading program. It is futile to compare the value of learning to study with the value of learning to appreciate good books. Both values must be provided for in every grade in the elementary school. This reader presupposes and supplements the literary readers and is to be

distinguished from them in its purposes, methods, and measures of accomplishment.

Above all, it is not meant for an oral reader. It must be studied — silently. Such reading is to be sharply contrasted not merely with oral reading, but with the silent, leisurely reading of literary selections. Its watchword is "Work" rather than "Recreation." Its emphasis is not so much on appreciation as on comprehension, on soundness of judgment, and on skill in remembering.

And yet its motivation is none the less firmly rooted. It arises from the desire of the child, first, to enlarge his experience with interesting things, and, second, to obtain a skillful control of the tools which will enable him to use the storehouses of information. These tools are the skills involved in silent reading of the study type.

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THE LEARN TO STUDY READERS

BOOK FIVE. GRADE SIX

DO YOU REMEMBER WHAT YOU READ?

How do you study a lesson in history, or in hygiene, or in geography? Many pupils think that they have studied a lesson if they have read it through once. Of course no matter how you study a lesson you must be sure that the important things in the lesson will be remembered. Do you know how much you remember when you read a new lesson in history or hygiene only once?

The amount that you remember after reading a lesson only once depends upon three things: first, it depends upon how hard the lesson is which you are studying. Of course very simple lessons will be remembered more easily than very hard ones. Second, it depends upon how much you already know about the lesson. Suppose, for example, you are reading a hygiene lesson on how to prevent a cold. If you already know a great deal about how to prevent a cold, you will remember more of what you read than you will if you know very little about this subject. Third, it depends upon how much ability you have to work well.

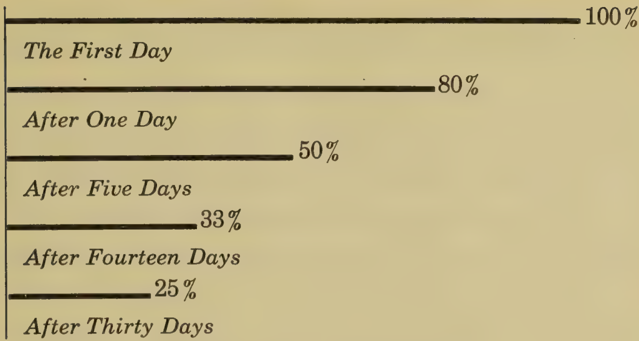
Not all the pupils in a class therefore can expect to remember the same amount from a lesson after

reading the lesson only once. Very few pupils can expect to remember even for a few minutes as much as two thirds of the important things in the lesson. Most pupils will find that even if they are tested as soon as they have finished reading a lesson, they cannot remember as much as half of what they have read. If a lesson is very difficult, they will find that they cannot remember more than a third of the important points in it.

If an important lesson is read only once and not talked over in class, so little will be remembered after a month has passed that it is almost impossible to tell any difference between pupils who have read the lesson and pupils who have not read it. Even if the lesson is read once and then talked over in the recitation, much will be forgotten by the end of a month.

Though the material be learned perfectly on one day, it will still be forgotten if the lesson is not studied later. This is true even in learning a poem. The graph on page 15 shows the amount that was forgotten by some persons who learned a poem just well enough to say it once without making a mistake.

The first line on the graph shows that the poem was learned perfectly. Follow the black line for



HOW MUCH IS REMEMBERED?

"The first day" out to 100 per cent. This means that it was learned well enough to be said without any mistakes.

Follow the black line which shows how much was remembered after one day. It stops at 80 per cent. How much was forgotten in just one day?

From the graph tell how much of the poem was remembered after 5 days; how much after 14 days. How much of the poem was remembered after a month?

You can see from this graph that even when a pupil has memorized something perfectly he begins to forget it very soon, and by the end of a month he has forgotten a very large part of what he learned.

HOW TO REMEMBER WHAT YOU READ

Just as men are trying to invent better machinery, and to discover better ways of treating diseases, so men are trying to find out better ways to remember. We do not yet know as much as we should like to know about memory, but what we have learned tells us to do the following things:

1. Be sure that you know clearly, before you begin to read a lesson, the definite purpose for which you are studying it. In school, no doubt, your teacher will have talked the lesson over with your class before you begin to study it, and will have chosen certain questions that you should be able to answer after reading the lesson. In the reading you do at home you must decide for yourself what you expect to learn from what you read. It is usually easy to do this. For example, you may decide to read a book in order to find out how to build a radio.

2. Be sure to read carefully enough so that you understand exactly what the book tells you. If you do not do this, you are likely to remember some things that are not true.

3. In each lesson decide what you should remember. Of course, no one should try to re-

member everything he reads. Only the important things should be remembered. It is helpful when you have finished a paragraph to ask yourself, "What question does this paragraph answer?" If you think that the paragraph answers an important question, write that question on a sheet of paper. Save these questions to use later in testing yourself.

4. When you have finished your lesson, try to recall the important things in it. You may do this by trying to answer the questions which you wrote down for each important paragraph. After you have tried to answer each of these questions, turn back to the book to make sure that your answer is correct. If you made a mistake in any answer, study that part of the lesson very carefully, for otherwise it will give you trouble the next time you try to remember it.

5. Another good way to remember is to make an outline of the main points in the lesson as soon as you have read it through once. After you have written your outline, read your lesson again to see whether or not you have left out any of the main points. This helps you to remember the lesson as a whole. Several lessons in this book give you practice in applying this rule.

6. However, you have already learned that, even if you learn your lesson perfectly for today, you will begin to forget it within a few hours, and in a few weeks will have forgotten most of it unless, in the meantime, you have reviewed it. This means that you must come back to each important lesson after a few days or weeks. One way to do this is to save the questions which you wrote down in preparing the lesson the first time, and then try to answer them after two or three weeks have passed. You can then re-read the lesson rapidly to see what you have forgotten. This will show you just what you need to study again. Another good way to review is to try to make an outline of the main points which should be remembered from the lesson. By reviewing a lesson a number of times in these ways, you can learn it so well that you will remember it for years.

The next lesson gives you practice in using some of these rules.

PRACTICE IN REMEMBERING

The best way to discover whether or not you have really learned the lesson on "How to Remember What You Read" is to try to apply it. The following lesson, "More Dangerous than Dynamite," is a good lesson to give you practice in applying the first four rules for remembering what you read.

Try to use these rules in learning this lesson. Do you remember what these points are?

1. Before reading the lesson, ask yourself the question, "What is this thing that is more dangerous than dynamite?" What do you think it is?

2. Next read the first paragraph. This is the introduction to the lesson. Does it tell you anything that is important? If you think so, can you ask the question that it answers? Write out the question.

3. Now read the second paragraph. Does it tell anything that you should remember? Can you ask the most important question that it answers? Sometimes a paragraph answers not only one main question but also other important questions. Does this paragraph do this? Write out each important question that it answers.

4. Study each paragraph in the same way. Remember that you should write only the important questions.

5. When you have finished studying the last paragraph, try to answer the first question that you wrote. You need not write this answer. Then read the first paragraph rapidly in order to see whether or not you answered the question right. If you did not remember all the important things in the answer, write a new question about the part of the answer that you missed.

Do the same for each of the questions which you wrote. When you have answered each of these questions in turn, go back and try again to answer the questions that you did not have quite right on your first attempt.

Keep this up until you can answer each question exactly right.

What shall you need to do in the future to make sure that you will not forget what you have learned?

MORE DANGEROUS THAN DYNAMITE

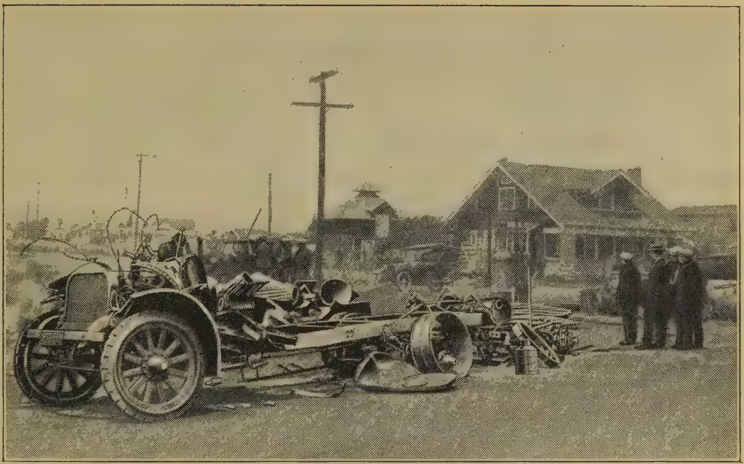
When in 1867 the Swedish inventor, Alfred Nobel, gave to the world a substance which he named "dynamite," people gasped at the terrific explosive force that was contained in a small stick of this material. Today dynamite is so well known that most people have learned to think of it as something of terrible explosive strength and something which must be handled with the greatest care.

There are, however, in common use, several liquids which, bulk for bulk, possess destructive

power far more terrible than that of dynamite. The most common of these liquids is gasoline. Gasoline is used by almost everyone. Most people handle gasoline without thinking very much about it. Many people who handle it very carelessly would waste no time in getting as far away as possible from a charge of dynamite. And yet the vapor from a single quart of gasoline mixed with the air of an ordinary-sized living room will make an explosive which, if set off, may do far more damage than a stick of dynamite. Besides, gasoline vapor is more easily set off than is dynamite.

So long as gasoline is kept under control it is one of man's most useful servants; but let it once have an opportunity to escape and turn into vapor and it will kill and burn. Nor is there anything mysterious about this danger. Anyone can understand it. When gasoline is exposed to the air either by being left in an open can or by being spilled upon the ground, it turns into vapor or gas. When it changes into vapor, it expands so greatly that one gallon will produce many hundreds of cubic feet of gas.

Most vapors quickly scatter through the air and float harmlessly away. Gasoline does not do this. It is heavier than the air. It will settle to the floor



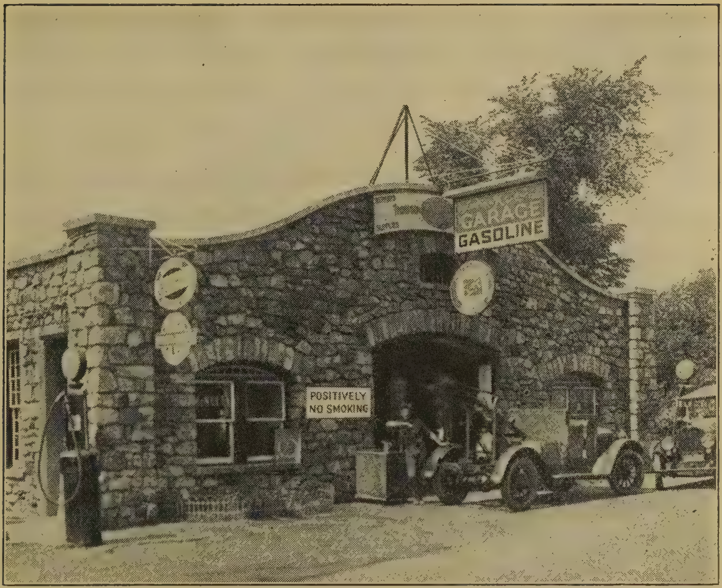
WHAT REMAINED OF THE TRUCK
Courtesy of the National Board of Fire Underwriters

or ground and flow along like the water of a stream, filling every hole or low place. It may stay in one place for days, if there is no current of air to blow it away, unseen and unsuspected until a chance spark or flame touches it off. It is very important, therefore, that good ventilation should be provided wherever gasoline is stored or used.

One disaster which occurred in Downey, California, will show how terrific a gasoline explosion may be. A tank truck was filling a gasoline tank at a roadside service station. Some of the gasoline

was spilled upon the ground and vaporized into the air. In some way a spark was struck. As a result an explosion occurred in which the truck was thrown through the air a distance of forty-eight feet. One person was instantly killed and others were burned so badly that they died from their injuries. A group who were standing fifty feet away were covered by flames and their clothes burned from their bodies. Persons who were more than one hundred and fifty feet away were blistered by the heat before they could turn and run. Others who were two hundred feet away, although not burned, were thrown violently to the ground. In one direction all the vegetation was scorched for five hundred feet. The service station was completely destroyed. The picture on page 23 shows what was left of this truck.

When the tank of a car is being filled with gasoline at a service station, it is almost impossible to avoid spilling some of the gasoline. This gasoline rapidly forms into vapor. On a day when the air is still, you can see that a good deal of vapor would be formed if a large number of cars had been filled. Perhaps you have noticed the smell of gasoline around a service station. This means that the air has gasoline vapor in it. You



© Ewing Galloway

can see, then, that it is very important that no one should smoke in an automobile which is standing near a service station or is receiving gasoline.

Many terrible accidents are caused by the use of gasoline in cleaning. To clean gloves and clothes with gasoline may seem a great convenience, but this method of cleaning is very dangerous. It has caused many people to lose their lives and many buildings to be burned. The fumes of the gasoline spread out in all directions, and if they come in

contact with a lighted cigar, a burning gas jet, a burning coal in a fireplace, or even the merest spark, an explosion instantly takes place with a flash of fire to whatever inflammable material is near. A nail in one's shoe striking against metal may produce a spark. An explosion may even be caused by rubbing gloves together while cleaning them. Those who use gasoline for cleaning purposes should remember that five cents' worth of gasoline is enough to blow up an ordinary house.

The ease with which gasoline is set off is amazing. In one case where gasoline was being used for cleaning, the vapor was carried outside a building to a lighted lamp nearly thirty feet away, where it took fire and flashed back to the building, which was entirely destroyed. In another case the mere opening of a door between a room in which the gasoline was being used to clean a pair of gloves and a room in which there was a lighted lamp caused a destructive explosion.

It is always dangerous to clean with gasoline. It is better to use some cleaning fluid which will not take fire. Several safe fluids can be bought at any drug store. If gasoline is used at all for cleaning purposes, it should be used out of doors and away from fire of any kind.

Many explosions are caused by attempting to start a fire with gasoline. It is dangerous to start a fire with kerosene, but when gasoline is used for kerosene by mistake the danger is much greater.

Everyone should know how to keep gasoline. It should never be allowed to remain in an open vessel or in a bottle that is not tightly corked. It should never be poured down a sink, because of the way the vapor or fumes spread. The fumes might even pass through the sewer and come up in another house. Never keep gasoline in a glass bottle, for if the bottle is dropped it may break and let the liquid escape. No one should keep a large amount of gasoline in or near the house. Many states now have laws which provide that any container for gasoline must be bright red in color with the word "gasoline" in a different color. This is to prevent gasoline from being used for kerosene. Many terrible fires and explosions are caused by making this mistake.

WHAT BOYS AND GIRLS CAN DO TO PREVENT GASOLINE EXPLOSIONS

There are many things which boys and girls can do to prevent gasoline explosions. Some of these things they can do by themselves; some they may persuade their parents or older friends to do. The chief things that people need to be careful about can be grouped under three heads: first, the use of gasoline in cars; second, the use of gasoline in cleaning; and third, the storing of gasoline.

In order to list all of the suggestions which you may have for care in using gasoline, make out a chart like the one below, and fill in your suggestions. When you have finished your list, put a cross before each one of the things which boys and girls can do to prevent gasoline explosions.

Care in the Use of Gasoline

In Cars	In Cleaning	In Storing

HOW TO USE AN INDEX

On page 31 you have one page of the index from Fisher's "Resources and Industries of the United States." An index is a great time-saver if you know how to use it. These are some of the ways in which the index of a book is of use:

1. An index gives the main topics which are told about in the book.

As quickly as you can, from this page of the index, tell whether you will find these topics discussed in Fisher:

silver, salmon, rubber, shoes, soft coal
raisins, sand, sawmills, spruce, rainfall

Salmon is the first word not found on the index page. But although it is not given as a main topic, if you had the whole index of this book you could find *salmon* listed under these main topics:

Alaska, salmon fisheries
Canning, of salmon
Fisheries, Pacific-coast salmon

Now go back through the list of topics again and suggest places where you might look for those which are not listed on the index page.

In the same way suggest where you would look in an index to find information about these subjects if they were not listed as main topics:

butter	seals	clay	oranges
automobiles	jewelry	Yellowstone	grain
cedar	mining	New York	slate
furniture	telephone	mosquitoes	spices

2. An index usually lists the chief things that are told about each main topic.

The subjects which are listed under each main topic are called subtopics. Find the topic *Rice* and read all of the subtopics. Read all of the subtopics under *Silk*. Sometimes an index does not give subtopics, but lists the numbers of pages in this way:

Rice, 26, 44, 47, 49–51, 89

If you wanted to find out how rice is raised, with the above kind of index you would have to turn to each page listed until you found what you were looking for. When the index gives subtopics as on page 31 you can easily tell whether the subject you are looking for can be found in the book.

Find these subtopics:

uses of rice	kinds of soil
future trade of South America	clay for pottery
	wooden ships

INDEX

Which subtopics would help you in finding answers to these questions:

How important a seaport is San Francisco?
What is the turpentine production of South Carolina?
Are there minerals in South Dakota?

3. An index usually gives the number of the page on which any topic is to be found.

The list of topics and subtopics would not be of much help unless the pages for each topic and subtopic were given. How many pages would you read for each of the following topics?

a. Nuts, 56
b. Apples, 34, 48, 131
c. Wheat, 148-162
d. Gasoline, 78, 205-208

Take paper and pencil and number down the side of your paper from 1 to 12. Now using the index on page 31, find and write down on your paper the number of the page, or pages, to which you would turn in finding the answers to these questions:

1. What part do Japan and China have in silk production?
2. How is soap made?
3. What is rice used for?

4. What are some of the important products of the Rocky Mountain region?

5. How is silk thread made?

6. What effect does the rainfall of Nevada have on the population?

7. Where does sorghum grow?

8. From what places do we get our supplies of rubber?

9. What is the annual rainfall of the Gulf states?

10. How does Russia compare with our country in grain production?

11. Is rice a native plant of South Carolina?

12. What modern methods have made it possible to build steamboats in less time than formerly?

13. What is the Government doing to reclaim waste land?

14. Where in our country is building stone found?

15. How does the wheat crop of the Red River Valley compare in size with that of California?

16. What are the common uses of southern pine?

17. What do we export to South America?

18. How has Savannah's position on the coast affected its development?

MENES

AN-AM

CHING

HOW WE CAME TO HAVE NUMBERS[1]

PART I

It is so very, very long ago that not even the wisest men of China can tell the year or the century in which little Ching, the king's oldest son, played in the forests at the foot of Mount Yu, and painted a face on the shell of his biggest turtle, and told the soldier who guarded him what a lot of turtles he had. To be sure, Ching had only three turtles, but he didn't know a word for "three," and the soldier didn't, and not even the king could do more than say, "Yes, there are a lot of turtles."

For all this was so long ago that even in the oldest parts of the earth, of which China was one, most people could not count. It was before kings had palaces or crowns or royal robes, and when

[1] Smith, Number Stories of Long Ago.

they were little more than savages. So we do not wonder that Ching, even though he was the son of a king, could only count "one, two," everything beyond that being a "lot." This was as far as people needed to count when Ching was playing in the forest at the foot of Mount Yu, for money was not invented, and we use our numbers today chiefly in buying the things we need. But in those days kings had many slaves and made them work, and sent them to kill animals, and made them bring back skins for clothing and meat for food. Few people needed to count, and only these few ever learned. Even the wisest men did not know much about the numbers that we use every day, because they had no need to do so.

At the time that Ching was growing up in China there lived on the plains of Mesopotamia, in southern Asia, a boy named An-am. He was the son of Bel, a shepherd of the country afterwards called the land of Babylon. Bel tended the sheep, and drove away the wolves that prowled about at night, and kept a careful watch to see that not one of his flock should wander away. One day Bel called out to An-am, "There are many sheep out there; drive them back." But really there were only a few sheep, for neither

An-am nor Bel could count beyond three, and all larger numbers were called "many." Nevertheless Bel and An-am knew the sheep so well that they could tell if one was missing, just as a good shepherd dog today knows if one of his flock has gone astray. So An-am and Bel could count "one, two, three, many," and that was all they needed to know about arithmetic.

While Ching was playing in the forest at the foot of Mount Yu, and An-am was helping to watch the flocks that fed near the Euphrates, another boy was living on the banks of the Nile in ancient Egypt. This boy's name was Menes, and he lived not far from the place where now the enormous dam holds back the waters of the great river. The little hut in which Menes lived was the grandest house that he or his father or his mother ever saw, and yet it had only a single room, and this was smaller than the schoolroom in which you study arithmetic.

For this was thousands of years ago, long before people had real houses, long before anyone knew how to read or write, long before the world had learned how to weave fine cloth, and long before men knew any other way to make a light than to rub two pieces of wood together until one of them

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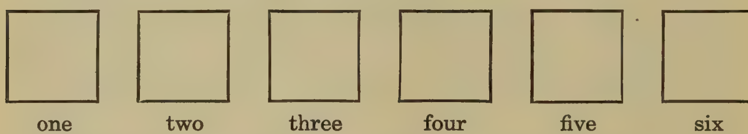
A SHEPHERD OF BABYLON TENDING HIS FLOCK

was set on fire. Menes was proud of what he thought was the magnificent house in which he lived, although it was only a little hut, and he was glad to be able to say, "We have a great many palm trees about our house," although there were only six. For Menes had heard his father and mother speak of one tree, of two trees, of three trees, and of four trees, but beyond that they simply said, "a great many trees," for they had names for numbers only up to four, and all be-

yond that was a great many, just as we might speak of a great many apples.

EXERCISES

A. Show how Ching, An-am, and Menes would have counted the squares pictured here:



How would Ching have counted them?
How would An-am have counted them?
How would Menes have counted them?

B. Answer these questions in as few words as you can:

1. In what country did Ching live?
2. What was his father's position?
3. In this story what was Ching counting?
4. How many did he have?
5. What was the highest number he knew?
6. Where did An-am live?
7. What did his father do?
8. In this story what were An-am and his father counting?
9. What was the highest number name they knew?

10. In what country did Menes live?
11. At the time in which Menes lived, which of the following things did the people know how to do?
    a. Build huts to live in
    b. Read and write
    c. Weave fine cloth
    d. Make a light by rubbing pieces of wood together
12. In this story what was Menes counting?
13. What was the highest number name he knew?
14. In which country did the people count farthest?

C. Write a few sentences to explain why the people of those times did not need to learn to count.

HOW WE CAME TO HAVE NUMBERS

Part II

When Ching and An-am and Menes grew to be men, and Ching became a king, and An-am became a manager of the Babylonian king's estates, and Menes became a great captain in the wars against the savages who lived in the south, Ching could only count to two, and An-am to three, and Menes to four, because this was as far as people in their countries could count in the days when the world was only just coming out of savagery, when money was unknown, and when no one measured land or buildings or the things which they traded with one another.

But many hundreds of years later other boys played in the forest at the foot of Mount Yu, and they counted "one, two, two and one, two twos, two twos and one, a lot." The world was growing, and people needed larger numbers, and so they counted as far as "two twos and one," which we call "five," and all beyond that was simply called a "lot."

And other boys helped to tend the flocks of Babylon, and their fathers taught them to count by threes, — "one, two, three, three and one, three

A ROADWAY IN EGYPT

and two, two threes, two threes and one, two threes and two, three threes, three threes and one, three threes and two, many," for they did not know a word for four, so they couldn't say "four threes," and they just said "many"; but of course they said another word, using the language of ancient Babylon. The world of Mesopotamia was growing older, and people needed more number names; but they still had no money, and a few such names were quite enough.

While the boys were counting to "two twos and one" in China and to "three threes and two" in Mesopotamia, Egyptian boys played under the palms where long before their time Menes had looked with pride upon his father's hut. No longer, however, was there just a hut with a single room, for the world was growing still older, and the descendants of the Menes of long ago had now a house with two rooms, and the Menes of this time had learned a new way of counting. The people along the Nile had found that the fingers of one hand would help them with their numbers, and so they made new names as far as five, and Menes now counted "one, two, three, four, five, five and one, five and two," and so on to "five fives and four"; and then he gave up and said "a great many." He could count farther than the Chings and the An-ams, but "five fives and four" is only twenty-nine, and this does not seem very far to us. But this was long before people could read and write, when they used knives made of stone, and when they thought the world was growing old, while to us it seems to have been very young.

EXERCISES

A. Hundreds of years after the time of Ching, An-am, and Menes, what would the children in China, Babylon, and Egypt have called this number of circles?

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

China —
Babylon —
Egypt —

B. Answer as briefly as you can these questions about the ways of counting hundreds of years after Ching, An-am, and Menes lived:

1. At this time, what was the highest number name used by the people in China?
2. What were all numbers above that called?
3. By what number did these people count?
4. By what number did the people of Babylon count?
5. How high could they count, giving each object a different number name?
6. What were all numbers above that called?
7. What would they have called "ten"?
8. What had the people of Egypt learned to make use of in counting?

9. How high could they count, giving each object a different number name?
10. What was their highest number name?
11. What were all objects above that called?
12. What would they have called "fourteen"?

C. Tell four things you found in this chapter which make it seem to us that the world at that time was very young.

D. In these chapters you have learned something about how people lived in China, Babylon, and Egypt, as well as about how people in these countries counted. What have you learned about these topics:

What the people did for a living
What kinds of homes they had
What the children liked to do
How these countries were ruled
How people obtained the things they needed

HOW WE CAME TO HAVE NUMBERS

Part III

Hundreds of years again went by, and still new Chings and An-ams and Meneses played in the forests of Yu, or on the plains of Mesopotamia, or on the banks of the Nile; but now the world began to feel that "five fives and four" was not large enough, even in ancient Egypt. Then it was that someone thought that if people could count to five on one hand they might as well count to ten on two hands, and so the Ching and An-am and Menes of that day counted the trees and sheep by learning number names to ten, and then saying "one and ten, two and ten, three and ten," and so on to "ten tens, ten tens and one," and as much farther as they wished to go. The world had discovered that its ten fingers were useful in counting; and this was one of the greatest discoveries the world ever made. Although boys and girls speak different languages, they all have ten fingers, and so all civilized people today count by tens.

Near the equator, where the climate is hot and where people did not wear shoes, they counted their toes as well as their fingers, learning sepa-

rate number names to twenty, — not "one and ten," "two and ten," and "three-ten" (thir-teen), but "eleven," "twelve," and so on, with special names, to twenty, which they sometimes called "man finished," and beyond that they counted by twenties. Some of these people wandered to other countries and carried along with them their way of counting. But most of the people of the world did as the children of Ching and An-am and Menes did, — they counted by tens. When we hear of "threescore years and ten," and when the French speak of "four twenties" instead of eighty, we have two remaining bits of the old way of counting by twenties.

Thus the world learned from Ching and An-am and Menes, and from their children and their children's children, and so on for hundreds and hundreds of years, first to count by twos or threes, and then by fives, and then by tens, and sometimes by twenties. A few people tried to count by twelves, and so we have twelve inches in a foot, twelve ounces in the ancient pound, and twelve things in a dozen, but the reason why the world came to count by tens was because Ching and An-am and Menes and you and I have just ten fingers on our two hands.

EXERCISE

1. At the time told of in this chapter, what had the people of China, Babylon, and Egypt learned to make use of in counting?

2. How far could they count?

3. What would they have called 24?

4. By what number were they counting?

5. Why could this way of counting be used the world over, no matter what the language happened to be?

6. What difference did the climate of the hot countries cause in their way of counting?

7. By what number did the people in these hot countries count?

8. What was that number called?

9. Where now do we sometimes hear counting of this kind?

10. Which of these numbers have been used to count by?

2 3 4 5 6 8 10 12 14 16 18 20 25

CHOOSING PARAGRAPH HEADINGS

In the books you read you will see that the reading is divided into sections, or paragraphs. You can always tell where a new paragraph begins because the first word of the first line is set in a little farther from the edge of the paper than are the other lines in the paragraph. Look at the first word of this paragraph you are reading. It is not out in line with the first words in the other lines.

Paragraphs are not made according to length. They are not made according to the number of sentences. They are made so that each paragraph gives one main idea. As you study you should be able to tell exactly what each paragraph is about. Read this paragraph:

> One of the first practical uses of rubber was as an eraser of pencil marks. We still call an eraser a "rubber," that is, a thing we rub with. It was this use of the tropical gum which gave it its common name, and, since some of the first specimens of gum came from the East, it has often been called "India rubber."

A sentence or group of words which tells what a paragraph is about is called a paragraph heading. Which of these paragraph headings is the best for the paragraph you have just read?

1. *Rubber*
2. *How erasers were first made*
3. *The name "rubber"*
4. *How rubber got its name*

You will see that paragraph heading number 1 is not good because it does not give an exact idea of what is in the paragraph. Number 2 is not good because it does not state the main idea, or the main purpose, of the paragraph. Number 3 is better, but it is not so good as number 4, which tells exactly and clearly what the paragraph explains.

In the same way, for each of the following paragraphs tell which is the best paragraph heading and why you think it is the best.

I. The United States mines over half of the world's yearly output of copper. Michigan, Montana, and Arizona are the chief states in which it is found. On the Keweenaw peninsula in Michigan there is a copper district seventy miles long and from three to six miles wide. The Indians have taken copper from this region for many ages, and their mines, sometimes with great lumps of copper in them which the Indians had been unable to lift out, were discovered by the whites when they came. In Montana there is a district called Butte, which is the greatest copper camp in the world. The copper mined in Arizona does not come from one particular place, but from many different localities within the state.

1. *Copper*
2. *Copper mining*
3. *Chief copper regions of the United States*

Which is best? Why?

II. Goatskins have long been used in the East for holding liquids, and they are still used for carrying water in Palestine, and for churning milk among the Bedouin Arabs. But generally now they are prepared for uses similar to those of sheepskin. Morocco leather was originally made from goatskins, and has always been greatly prized for its fine, soft quality.

1. *Uses of goatskins*
2. *Goatskins*
3. *How morocco leather was made*

Which is best? Why?

III. The reasons why wool is manufactured in the East, far from the regions of supply, are somewhat like those which led to the building of cotton mills near the sea. The wool-raising regions of this country are, in the first place, unfavorable for manufactures; and, secondly, they are unable to furnish us with all the wool we need. Some wool must be sent to us from abroad, and woolen mills are built near the seaports so that the owners shall not have the expense of further transportation.

1. *Where wool is manufactured*
2. *Why wool is manufactured in the East, far from where it is produced*
3. *Where the wool-raising regions of this country are*

Which is best? Why?

IV. The best soil for raising wheat is one which is somewhat clayey, but not too stiff and heavy; in other words, light clayey soils or good loams are considered suitable. It is true that wheat is not very exacting about the kind of soil on which it is grown. If other conditions are favorable, it is possible to raise a fair crop from a heavy or even from a sandy soil; but to produce the best results a well-drained, loamy soil is essential.

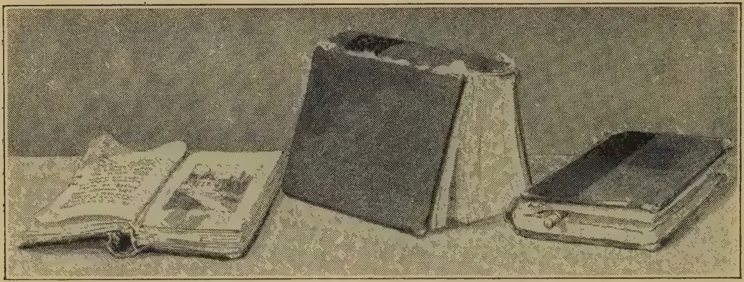
1. *Kinds of soil*
2. *What soil is best for wheat*
3. *Our wheat crop*

Which is best? Why?

V. The most valuable variety of sheep for wool is the merino, which was imported into this country from Spain in large numbers in 1810. The skin of the merino sheep does not fit its body very closely, but hangs in folds, like the overcoat of a large man on a small one. The number of square inches of skin upon which wool can grow is therefore very large. The number of hairs, too, that grow upon each square inch is very great; the old German sheep is said to have had 5500 hairs to the square inch, whereas the best merino breeds have 48,000. This means not only that the wool is dense, but that the strands or fibers are very fine.

1. *Why the merino sheep is best for wool*
2. *Best sheep for wool production*
3. *Best kinds of wool*

Which is best? Why?



HOW BOOKS ARE SPOILED

No one likes to use dirty, torn books. We like new, clean ones much better. But all too soon a book which was clean and straight and whole when it was new becomes soiled and torn and bent out of shape from careless handling.

The picture above shows some ways in which books are spoiled. The statements in the list on the next pages tell some more ways in which books are spoiled because they are not kept clean, because people mark their places in wrong ways, and because the bindings are not kept in good shape. But these statements are not arranged in good order; not all of those about keeping books clean are together. Neither are all of those about marking the place or breaking the bindings together.

Write on a sheet of paper these three group headings, using every other line:

Keeping a book clean

Marking the place in a book

Keeping the binding in good shape

Then read the following statements and decide to which group each belongs. If number 1 is about keeping a book clean, put "1" on the line below the heading "Keeping a book clean." Then read number 2. Do not write the statement; put only the number of each statement where it belongs.

SUGGESTIONS FOR THE CARE OF BOOKS

1. Dirty hands make dirty pages.
2. Marking the place with rulers and pencils makes the covers bulge.
3. Leaving books lying face-downward loosens the covers.
4. A piece of paper or a ribbon makes a good marker.
5. Eating food and reading books do not go together; the books will suffer.
6. Opening a new book carelessly breaks the back and loosens the pages.

7. Dropping heavy books loosens the bindings and may tear the pages.

8. Heavy weights on books crack their bindings.

9. Books are often spoiled by pencil marks.

10. Squeezing too many books upon a shelf loosens the covers.

11. Turning down the corners of pages makes them ragged.

12. If a book on a shelf leans on the edge of one cover, the cover soon becomes warped.

13. Books resting on their front edges soon bend their covers out of shape; they should rest on their lower edges.

14. Wetting the thumb or fingers in turning pages soils books and often tears them.

15. Water, rain, hot sun, or heat from radiators melts the glue in the back of a book and spoils the binding.

16. Strapping books too tightly breaks the edges of their covers.

17. Rain and snow spot books.

DICTIONARY TEST LESSON ON LOCATING WORDS

To locate words rapidly in a dictionary you must first understand the order in which words are arranged in the dictionary, and then make use of the guide words at the top of each dictionary page which tell what words may be found on that page.

How well can you do these things?

1. Arranging words in the order in which they would be found in the dictionary.

Write the words of each line in their dictionary order. Do *a*, then *b*, and so on.

a. stamp, check, knife, paper, frown
b. basket, butter, biscuit, berries, bottle
c. party, pace, paint, page, paws
d. circumspect, circumnavigate, circumference, circumstance

2. Using the guide words to help locate words.

At the tops of four pages in one dictionary are the following pairs of guide words:

SCORER	SCRATCH
SCRATCHER	SCUFFLE
SCULL	SEAL
SEALER	SECOND

The first word given is the first word on the page; the other word is the last word on that page. Can you tell what words would come between them? Where would *scorn* come? On which page would *scud* be found?

Now tell on which page each of the following words would be found:

scorn	scour	script	seat
scud	seam	seal	season
scrim	scowl	scrub	scout
seclude	scuttle	scythe	search
seaweed	sculpture	screw	scrunch
scrimp	scramble	seasoning	scourge

3. As fast as you can, list words which would be found on each of the pages whose guide words are listed below. Try to get at least three for each page.

1.	PAPER	PATTER
2.	TASTE	TEA
3.	GARDEN	GATE
4.	MERRY	MEW
5.	FAIL	FAMOUS
6.	BAKE	BANK
7.	SLED	SMOOTH
8.	HEIGHT	HEN

WHERE OUR LUMBER HAS COME FROM[1]

[Our country has been very fortunate in having great forests from which to obtain our supplies of lumber and other forest products. In this lesson you will read something about the places from which the lumber has come. Read through carefully, noticing particularly the different parts of our country which have at some time produced great amounts of lumber. As soon as you have finished, you will be asked to answer a list of questions about what you have read.]

Though we once had immense forest resources throughout the United States and what we thought was an unfailing supply of lumber, more than half of our best forests have already been destroyed, and the center of the lumber industry has moved from one place to another as each forest region has taken its turn in furnishing lumber.

The first of our softwood forests from which many trees were cut to supply lumber was the pine and spruce forest of New England. Much lumber was cut to build houses and ships for the colonists in Massachusetts, New Hampshire, and

[1] Fisher, Resources and Industries of the United States (Adapted).

Maine. In those days Bangor, Maine, was the leading city of the lumber trade.

As the trees of the New England woods were cut, the lumber industry had to work new forest lands. Lumbering moved steadily westward through New York and Pennsylvania. By 1880 the logs cut from the pine woods of Michigan and Wisconsin and shipped southward by lake to Chicago made that city the center of the lumber trade. Through Ohio and Indiana the trees of the great central hardwood forest — oak, maple, and walnut — were cut as the settlers moved to the westward, not because lumber was needed but because it grew on land that was needed for farms.

Soon so many of the trees of the Great Lakes forest had been cut that these states could no longer supply our needs. The Southern states then took their turn, and the yellow pine from Southern forests took the place of the white pine of the North. In 1900 the Southern states led in lumber production. As the woodlands here are cut we are turning to the great Douglas fir forests of the North Pacific coast, and Washington is now our leading lumber state.

TEST LESSON

Below you will find some questions to be answered by "Yes" or "No." Take a sheet of paper; put on it your name, grade, and the date; number along the edge of your paper to twenty-five. Try to answer every one of the questions.

1. Did we ever have immense forest resources?
2. Are half of our forests left?
3. Was lumber first cut in a large amount in New England?
4. Were the forests of New England hardwood?
5. Was Maine one of the first states to supply much lumber?
6. Would you have bought yellow pine in Bangor?
7. Was Bangor a leading lumber city?
8. Did the lumber industry move westward after the New England forests were cut?
9. Were Pennsylvania and New York leading lumbering states?
10. Was the lumber center in the South in 1880?
11. Was lumbering carried on in Michigan and Wisconsin?
12. Was Chicago the center of the hardwood lumbering?

13. Was Chicago's position on the lake responsible for its importance in lumber?

14. Was the great hardwood forest in Wisconsin?

15. Was the hardwood forest cut chiefly for lumber?

16. Did the lumber industry move westward when it left the Great Lakes states?

17. Were the Southern forests yellow pine?

18. Were the Northern forests white pine?

19. Was the center of lumber production near Chicago in 1900?

20. Are there any more forests to use when the Southern forests are gone?

21. Are the great Western forests in southern California?

22. Are the Western forests mostly hardwood?

23. Is maple a hard wood?

24. Is Washington now our leading lumber state?

25. Is Douglas fir found in the Western forests?

HOW TO CARE FOR A CUT

Did any of these accidents ever happen to you?

Stepping on a piece of broken glass and cutting your foot
Cutting your hand with a knife while you were whittling
Falling on a sharp stick and cutting your knee
Cutting your hand on the ragged edge of a tin can

If such an accident should happen to you or to one of your playmates, should you know how to care for the cut?

A cut which is properly cared for at once is not likely to become sore. A cut which is neglected may become infected from dirt and germs and

may cause much pain. Even a slight cut, if it is not taken care of, may lead to blood-poisoning.

You can see that it is important for every boy and girl to know how to care for a cut promptly. If the cut is very large or if it has already become infected, the doctor should care for it. If the cut is slight, you can care for it yourself.

These are the things to do for a cut.

Allow the cut to bleed freely. The blood helps to wash out and to kill germs which may be in the wound.

If a clean instrument has made the wound, do not wash the cut. If a dirty instrument has made the cut, or if dirt has entered the wound, wash the cut with clean water. Use a piece of absorbent cotton. Dip the absorbent cotton in the water and gently wash all the dirt out of the wound. Tincture of green soap, which is a soap in liquid form, is excellent for washing a cut.

After the cut has stopped bleeding, wash or paint it with iodine. The stoppers of most iodine bottles have a small glass rod with which to apply the iodine. If your iodine bottle has no glass rod, apply the iodine with a toothpick covered with cotton. Paint every part of the wound. Be careful not to spill the iodine on other parts of the body

because it is liable to cause a blister. Never use iodine on cuts near the eyes. Iodine will stain clothing, rust scissors, and mar furniture and floors. Be very careful not to spill the iodine.

After a cut has been treated, it is usually wise to bandage the wound, unless it is slight. This keeps dirt from getting into it. Gauze or cloth may be used, but either should be very clean. A dirty bandage will cause the cut to become infected.

Never put a thick, heavy bandage on a cut. Use only a few thicknesses of cloth, so that the air can get to the cut. An easy way to bandage a cut is to cover it with clean gauze, holding the gauze

in place by means of a piece of adhesive tape over each corner. The illustration on page 63 shows a cut bandaged in this way. Never cover a cut with court-plaster, since this shuts out the air. Change the bandage when it becomes dirty.

For the treatment of cuts it is necessary to have certain things always on hand. Two important things to have on hand are iodine and bandages.

A small bottle of iodine in a wooden box, which prevents the iodine from evaporating, can be purchased for fifteen cents. Remember that iodine is a deadly poison. For this reason the bottle containing it should be carefully marked and kept out of the reach of small children.

One of the best materials for bandaging is a roll of sterilized gauze. This can be purchased at a drug store in different widths. The gauze should always be kept in a covered container so that it will be clean when needed.

DRILL IN MEMORIZING

Choosing the important rules to be remembered. It is important that you should remember what this lesson tells you about how to care for a cut. It may save you a great deal of pain.

Think over what you have read, and choose the important things to remember in order to care for a cut. Write these as rules. Below are the first two rules.

1. Care for a cut promptly.
2. Allow the cut to bleed freely.

Write as many more important rules as you can think of.

How to be sure you have all the rules. Usually we do not remember all the important things in a lesson from reading it once. Turn back to the lesson and read again to see whether you have left out any rules and whether you can make any of yours better.

How to remember the rules. Read your list of rules carefully. Now cover your list and see how many you can say. Keep doing this until you can say all the rules.

MAKING AN OUTLINE

In the first lesson in this book you found that making an outline of the main points of what you read will help you to remember the important ideas. This lesson will show you how to make an outline.

Read this paragraph about how the orchards of oranges and lemons are kept from being destroyed by frost. Then you will make an outline.

Every possible way of preventing frost is being tried in the citrus-fruit regions. We have all covered the flowers in our gardens or outside window boxes with cloth or paper to keep them warm when frost is expected. The great fruit groves cannot be so easily covered. When the United States Weather Bureau sends out warnings that frost is likely to occur during the night, coverings are quickly spread over frameworks of slats which have previously been made ready, or smudge fires are lighted to make a thick cover of smoke over the orchard. A cloud is sometimes formed above the trees by spraying fine mist into the air. This cloud serves as a blanket which prevents the escape of the heat that the earth has gathered during the day and so helps keep the temperature above the frost point. Some orchards have steam pipes running through them, so that when a frost is coming the heat can be turned on just as it is in our houses. On irrigated lands plants are often protected from frost by flooding the fields. This holds in the heat of the earth and prevents great changes in temperature.

The paragraph you have just read tells how citrus fruits are protected from frost. The paragraph tells five different ways in which fruit-growers try to protect their orange and lemon trees and other trees of the same kind. Read through the paragraph again and see if you can find the five different ways.

This is the way it would look if you put it on paper:

I. How citrus fruits are protected from frost
- *A.* By spreading coverings over frameworks of slats
- *B.* By lighting smudge fires to make a thick cover of smoke
- *C.* By spraying fine mist into the air to make a cloud blanket holding in the heat of the earth
- *D.* By running steam pipes through the orchards, through which heat can be sent
- *E.* By flooding the fields

This is one kind of outline. In making this outline we have put down the paragraph heading, and each of the points that explain it. These are called subpoints.

For each of the following paragraphs find the subpoints. Copy on your paper the paragraph heading just as it is given below the paragraph, and fill in the subpoints. In writing down subpoints it is always best to make them as nearly

of the same kind as possible. Make them short. It is not necessary to write the whole sentence.

I. After the wood and other vegetable matter has been buried for many years, it is changed into a soft, brownish coal called lignite. It is of all coals the most like wood in appearance and in the way in which it burns. It is a convenient fuel for household use. When the coal beds have been buried longer, or pressed down by heavier layers of sands and clays, a harder, blacker coal is formed. This is called bituminous coal. Bituminous coal is more valuable than lignite. It burns more slowly, with a bright flame, and gives off a dense black smoke. . . . When the coal layers have been still further changed, by longer burying or greater pressure, a still harder coal is formed. This is called anthracite. Anthracite is a clean, hard coal which burns slowly and steadily, producing little flame or smoke.

I. *Kinds of coal*

A.

B.

C.

II. From the fields the rice is taken to the mills for threshing, cleaning, and husking, and finally each little grain is polished, and the rice is graded, weighed, and packed for market. Many of the mills in the United States turn out from 1000 to 10,000 bushels of rice every twenty-four hours.

II. *How rice is made ready for market*

A.	*E.*
B.	*F.*
C.	*G.*
D.	

III. As soon as it is possible to obtain it at low cost, aluminum, because of its abundance and its many good qualities, can be substituted for various other metals. Its silver-white color makes possible its use in place of silver. Because of its strength and lightness it may make an excellent substitute for iron in the construction of aëroplanes and automobiles. Because it can be drawn into wire, transmits electricity readily, and does not rust or waste easily, aluminum is even now in a few localities replacing copper for the making of telephone wires.

III. *How aluminum can take the place of other metals*

A.
B.
C.

IV. The United States manufactures and uses more paper than any other country in the world — so much that our own supply of wood pulp is not equal to the demand and we are obliged to import it, especially from Canada and the Scandinavian peninsula. As the supply of wood for pulp becomes more scarce many substances may be used instead. Bamboo is one of the most promising substitutes. Five tons of bamboo fiber can be produced on one acre, and 45 per cent of it can be made into pulp. Paper can also be made from the fiber of the ground hull of the cotton seed and from the stalks of sugar cane after the juice has been pressed out. Other possible substitutes are cornstalks and flax straw.

IV. *Substitutes for wood pulp*

A. *D.*
B. *E.*
C.

READING ALOUD TO OTHERS

All the reading you have done in this book so far has been of the kind which you do silently. You have not been reading it aloud to others. You have been doing the kinds of reading which boys and girls usually need to do by themselves in order to study well.

But at times we all need to read aloud to other people. Sometimes a point in geography or history can be better understood by the class if it is read aloud. Sometimes it is necessary for the person who is reciting to prove that he is right or to explain his statement by reading from a book. Sometimes we need to read to other people the rules of a game, the explanation of some contest, an announcement, or a notice. And very often, no doubt, you find poems or stories or parts of stories which are so interesting that you would like to read them to the rest of the class. But do the rest of the class like to hear you read?

Why is it that we like very much to hear some people read, but dislike to listen to others? Here are some things which good readers do.

1. Good readers select very carefully the articles which they are to read. They try to choose an

interesting story or a worthwhile article, one which their listeners will surely enjoy. If they are reading to prove a point, they read only the sentences which are necessary. If they are reading an interesting story or part of a story, they select one which is not too long to be interesting.

Here is the rule: *If you want people to like to hear you read, select your story or article carefully.*

2. Good readers know well the story or article which they are to read. In the first place, they know the exact meaning of what they are to read. It would be hard to give the meaning to other people if the readers themselves did not know the meaning. In the second place, they know the words in the selection so that they will not pronounce them incorrectly and spoil the meaning for the listeners. This all takes time and study, but it is necessary if people are to read aloud well.

The second rule is: *Know well the selection you are to read aloud.*

3. Good readers keep their audience interested in what they are reading. They read loudly enough to be heard easily, and very clearly so that the listeners do not have to guess what they are saying. The points in the selection stand out very plainly and the characters talk like real

people. Good readers work and practice to do all these things well, in order to keep their audience interested.

And so the last rule is: *Keep your listeners interested to the very last of what you read.*

TRYING TO REMEMBER

Tomorrow you will read an interesting story about a journey across the Western plains of our country in the days when people had to travel in covered wagons. You will pick out some short part in the story to read to the rest of the class.

What have you learned in this lesson which will help you in choosing and preparing the part you wish to read? Can you remember the three rules for reading well aloud?

Try to name or list at least ten suggestions for reading well which you remember from this lesson.

ACROSS THE PLAINS IN 1846[1]

[In the story which follows, there are some very interesting parts which you will like to share with the rest of the class. Read straight through to get the whole story first. Then go back and pick out some short part in the story to read to the rest of the class. As you prepare your selection try to keep in mind the three rules for good reading which you have just read.]

I. THE JOURNEY

Before the days of railroads, those who made the overland trip to California suffered untold hardships. Thousands perished from hunger and exposure, or were killed by the Indians. A clear picture of the sufferings of these hardy Western pioneers is given in the story of the Donner party.

The central figure in the story is a little girl named Eliza Donner. She was less than four years old when her adventures began.

Eliza Donner lived with her parents and four sisters, one younger and three older than herself, on a farm near Springfield, Illinois. One day in

[1] Faris, Real Stories from Our History (Adapted).

the spring of 1846 she learned that her father and mother had decided to move to California. Such a journey was not so easy a matter as it is in this day of railroads. For many hundreds of miles of the way there was not even a wagon road. Roving Indians were everywhere. California was then a part of Mexico. Yet when the Donners decided to make the five months' journey, seven of their neighbors asked permission to go with them. In all, thirty-two persons agreed to share the dangers of the plains.

Eliza was much interested in the preparations for the journey. She saw three big white-covered wagons brought into the yard, and watched her parents as they loaded them. In one wagon they placed seed and farming implements for their own use in California, as well as laces, muslins, satins, and velvets which they hoped to trade for land. The second wagon held the supplies of food and clothing for the journey, as well as the tents and other things to be used in camp, and the bright-colored garments, beads, necklaces, looking-glasses, and so forth, with which unfriendly Indians were to be appeased. The third wagon was to be the family home on wheels. Each wagon was to be drawn by three yoke of sturdy oxen. Three extra

yoke of oxen, five saddle horses, beef cattle, and a dog were to follow the wagons.

It was a happy moment for Eliza and her sisters when the signal was given to start. They wondered why there were tears in their mother's eyes as they left the old home and passed the familiar orchards and the fields beyond.

The first weeks passed pleasantly. The loneliness of the days was frequently relieved by messages from others who had traveled across the plains before them. Some of these messages came by the hands of trappers and traders who were on their way to the East. More often they were penciled on the skulls of animals lying on the prairie, or on the trunks of trees from which a patch of bark had been cut. When neither trees nor skulls were near, those who wished to leave a message would write a note and fasten it in a cleft stick driven into the ground.

Travelers were accustomed to watch for such messages. When they were uncertain about the way, they usually found something to guide them. One day, however, they looked in vain, until some one caught sight of a guideboard. The disappointment of all can be imagined when examination showed that the note which had been pasted to

the board had been torn into bits. Evidently the crows had pecked the paper to pieces. Nobody knew what to do till Mrs. Donner began to hunt for pieces of paper on the ground, where the birds had dropped them. Others helped her. When they had as many bits as could be discovered in the tall grass, she slowly fitted them together on the guideboard, as a child matches the pieces of a picture puzzle. At last she was able to spell out the words:

2 days — 2 nights — hard driving — cross — desert — reach water.

The Donner party was at this time in a beautiful valley where there were twenty natural wells, and so it was decided to remain in camp until the oxen were thoroughly rested. Then, taking all the water they could carry, they started across the desert. The trip required twice the time the note had said. Before the next valley was reached, the wood of some of the wagons shrank till the vehicles were useless and had to be abandoned. Everyone in the party suffered from thirst, and many of the oxen perished from lack of water.

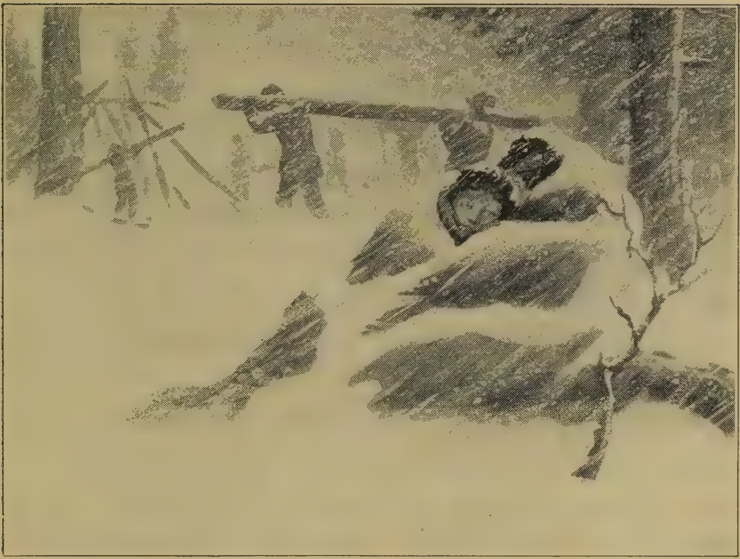
There were other delays. Some of the notes left for their guidance led them astray. Once they were thirty days in making a part of the journey

that should have required but twelve days. At another time the men made a road across eight miles of rocky country, only to find that they had to go back and start another way. These delays made the food supply short, and everybody was hungry. But all were willing to bear the hardships, for California seemed near, and when they reached the sunny land there would be plenty to eat and drink. Then Mr. Donner injured his hand while making repairs on one of the wagons. So many hours were wasted that it was impossible to cross the summit of the Sierras before the first great snowfall of the season. The party tried to go on, but they were soon unable to move.

They were stranded in the snow near the summit of the cold mountain. They had no shelter, they had little food, and it might be many weeks before they could push on to the valley. Their only hope was that some of the party who already had reached the valley would send assistance to them in season.

II. STARVING IN THE SNOW

Eliza Donner never forgot that first day and night in the snow in the lonely mountain valley. The day was spent by the men in felling and



trimming trees. A beginning had been made on a log cabin, when darkness put a stop to the work. The moon was shining when the weary pilgrims went to bed, but during the night there was a heavy snowstorm.

The snowfall made necessary a change of plans. Instead of finishing the log cabin, the tent was pitched on a cleared space, under a pine tree, and an Indian guide showed the men how to enlarge this shelter by a rude hut of poles and boughs. On the framework were laid pieces of cloth, old

quilts, and buffalo robes, as well as pine boughs. In a hollow scraped out under the tree a fire was built.

While the work was going on there was no shelter for Eliza and Georgia. "Mother tucked a buffalo robe around us," Eliza wrote, "saying, 'Sit here until we have a better place for you.' There we sat snug and dry, chatting and twisting our heads about, watching the hurrying, anxious workers."

Before the shelter was finished the snow was falling once more, gathering in a ridge beside the children on the log, and nestling in piles under the buffalo robe. They were glad of the call to enter the hut. There, after warming themselves at the fire under the tree, and eating their meager supper, they crept into the bed, which was made of boughs laid on posts.

For eight days the snowfall continued. Mr. Donner kept up his courage, in spite of his crippled hand, leading in the work of gathering fuel, and doing all he could to make others hopeful. Many of the cattle froze to death. The places where their bodies lay were marked, that they might be found later, as they were required for food. But the snow buried them out of sight, and few

could be found. The men would prod in the snow with long stakes, but they seldom discovered what they sought.

Food became so scarce that "the little field mice that had crept into the camp were caught and then used to ease the pangs of hunger. Pieces of beef hide were cut into strips, singed, scraped, boiled to the consistency of glue and swallowed with an effort. Marrowless bones that already had been boiled and scraped were now burned and eaten; even the bark and twigs of pine were chewed in the vain effort to soothe the gnawings which made one cry for bread and meat."

The wanderers were not only hungry, they were cold. "We little ones were kept in bed," Eliza says. "My place was always in the middle, where Frances and Georgia, snuggling up close, gave me of their warmth."

So the days dragged along for more than two months. "By the middle of January the snow measured twelve and fourteen feet in depth. Nothing could be seen of our abode except the coils of smoke that found their way up through the opening. There was a dearth of water. The creek was frozen over and covered with snow. Icicles hung from the branches of every tree. The

stock of pine cones that had been gathered for light was almost consumed. Wood was so scarce that we could not have fire enough to cook our strips of rawhide, and Georgia heard mother say that we children had not had a dry garment on for more than a week, and that she did not know what to do about it. Then, like a smile from God, came another sunny day which not only warmed and dried us thoroughly, but furnished a supply of water from dripping snow banks."

Every day they looked anxiously for the coming of relief in response to the pleas of a number who had pushed on in the face of almost certain death. The Indian guide would climb to the top of a tall pine tree and look intently for a moving speck in the distance. At last, about the twentieth of February, he saw somebody coming. Soon seven men were in the camp.

These men told how they had started with a number of others, and how they had been compelled to leave by the way most of the supplies they carried with them. Small quantities of flour were carefully measured out, together with a little jerked beef and two small biscuits for each of the famishing people.

When the rescuers started back to the valley,

they took with them four of the Donner party, including two of Eliza's sisters. Those who remained were told to look for the coming of other rescuers who were on the way.

Again began the days of weary waiting. Food was scarcer than ever. Mr. Donner's hand grew worse and he became weaker. Mrs. Donner did her best to keep up the courage of the children. Eliza says, "Often while knitting or sewing she held us spellbound with wondrous tales of 'Joseph in Egypt,' or 'Daniel in the lions' den' or 'Elijah healing the widow's son,' and of the tender, loving Master who took children in his arms and blessed them."

Eliza wrote thus of the failing food supply:

> The last food which I remember seeing in our camp before the arrival of the Second Relief was a thin mold of tallow which mother had tried out of the trimmings of the jerked beef brought by the First Relief. She had let it harden in a pan, and after all other rations had given out, she cut daily from it three small white squares for each of us, and we nibbled off the four corners very slowly and then around and around the edges of the precious pieces until they became too small for us to hold between our fingers.

Ten days passed. Then came the second relief party. There were only ten men in the party, and they, too, had left on the way most of the provi-

sions with which they had started, so that these might be eaten on the way back. After giving the survivors in camp a small supply of food, they were ready to return to the valley. Mr. Donner was so weak from his wound that he was unable to go with them. He begged Mrs. Donner to leave him with the children. She would not desert him, but offered three of the men five hundred dollars if they would take Eliza and her little sisters to a place of safety. When they agreed, she gave them a parcel containing a few keepsakes, with a little clothing that might prove useful to the girls in later years. Then she made what preparation she could for their future. When she had put on their cloaks and hoods, she said to them, "I may never see you again, but God will take care of you."

In her account of that sad day Eliza wrote:

Frances was six years and eight months old and could trudge along quite bravely, but Georgia, who was little more than five, and I, lacking a week of four years, could not do well on the heavy trail, and soon we were taken up and carried. After traveling some distance the men left us sitting on a blanket upon the snow, and went ahead a short distance, when they stopped and talked earnestly. We watched them, trembling lest they leave us there to freeze. Then Frances said: "Don't feel afraid. If they go off and leave us I can lead you back to mother by our footprints on the snow."

Evidently the men were weary of their charges; they seemed to fear that they could not get to the valley if they were burdened with the little ones. But they were not cruel enough to leave them in the snow; they carried them to a cabin not far away where others of the snowbound party were waiting for deliverance.

It was dark when the children entered the poor shelter. There was no welcome for them, but they were told to lie on a bed of branches on the ground. For a long time they could not go to sleep; other children in the cabin made their presence known by the pitiful plea, often repeated: "Give me some bread. Oh, give me some meat!"

Eliza and her sisters huddled close on their bed of branches, their arms tightly clasped around each other, and so, at last, they fell asleep.

III. FINDING A HOME

Days passed in the dark cabin. The snow fell drearily. Hunger was a constant guest. One day a little girl from a neighboring hut came in, bearing a number of biscuits which had been baked in the ashes. There was one for everybody in the cabin. "Few can know how delicious those bis-

cuits tasted, and how carefully we caught each dropping crumb," Eliza wrote of the event.

Another day there was a cry from a boy who stood on the snow above the cabin to see if any help were coming:

> I see — a woman — on snowshoes — coming from the camp! She's a little woman — like Mrs. Donner. She is now looking this way — and may pass!

Mrs. Donner heard the call of the frantic boy, and in a few moments she was with her children. She had heard that they were in the cabin, and had pushed her way over the snow. She told the children that there was still a half biscuit left from the supplies brought by the second relief party. Eliza tells the thoughts that biscuit brought to her mind:

> How big that half biscuit seemed to me! I wondered why she had not brought at least part of it to us. I could see that broken half biscuit, with the ragged edges, and knew that if I had a piece, I would nibble off the rough points first. The longer I waited the more I wanted it. Finally I slipped my arms around my mother's neck, drew her face close to mine and whispered, "What are you going to do with that half biscuit you saved?"

When Mrs. Donner answered, "I am keeping it for your sick father," Eliza was satisfied.

At last the third relief party came. Mrs. Donner asked the leader of the little company if he would take her children to safety. He said he would either save them or die with them on the trail.

The children were again dressed to start on their journey over the snow. Eliza has described their appearance:

> Georgia and I were clad in quilted petticoats, linsey dresses, woolen stockings, and well-worn shoes. Our cloaks were of a twilled material, garnet, with a white thread interwoven, and we had knitted hoods to match. Frances's clothing was as warm; instead of a cloak, however, she wore a shawl, and her hood was blue. Her shoes had been eaten by our starving dog before he disappeared, and as all others were buried out of reach, mother had substituted a pair of her own in their stead.

The way was rough. Snowdrifts were on every side. Icy ridges were to be crossed, where to slip or fall might mean death in the yawning depth below. The children struggled on as best they could. Eliza stumbled so much that one of the men put her in his blanket on his back and carried her as the Indian mother carries her child.

Days passed before the Sacramento Valley was reached. Here Eliza found a home with a kind German family, where she was treated as though she were an own daughter.

ANOTHER OUTLINE LESSON

On this page blank outlines are given for the paragraphs in the lesson beginning on page 48. Copy each blank outline on your paper, then turn back to the paragraphs and fill in the sub-points.

I. Chief copper regions of the United States
   A.
   B.
   C.

II. Uses of goatskins
   A.
   B.
   C.
   D.
   E.

III. Why wool is manufactured in the East, far from where it is produced
   A.
   B.

IV. What soil is best for wheat
   A.
   B.
   C.
   D.

V. Why the merino sheep is best for wool
   A.
   B.

Photograph by Ewing Gallowav

A FIREMAN TALKS ABOUT RUBBISH

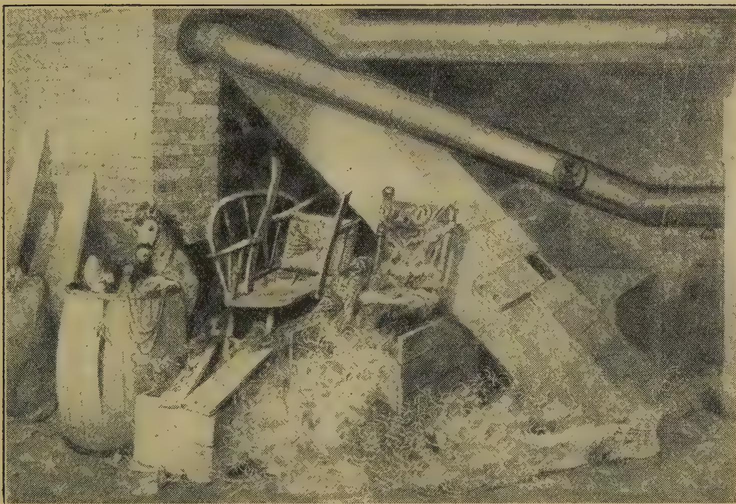
Tell me what you do with your rubbish, and I'll tell you what sort of citizen you are. If you dispose carefully of every bit of your broken furniture, all your old newspapers, your oily rags, your worn-out clothing, and all such rubbish, you are a good citizen; but if you allow them to accumulate, you are not only a bad citizen but a menace to your neighbors.

What makes such things catch fire? It may be the heat from the furnace, a spark from a cigarette, a candle dropped by someone, the torch of a plumber, or, perhaps, they just catch fire from what is called spontaneous combustion.

You don't know what spontaneous combustion is? It is a fire that starts itself. It has been discovered that cotton waste, oily rags, moist hay, and certain other things, if left to themselves, will grow hotter and hotter and finally burst into flame. There was once a new church that was destroyed in that very way. It had just been finished, and on the afternoon before the day set for the first service, some of the ladies of the church wiped the woodwork with oily cloths. When the ladies had finished the work and were going home, one of them suggested that it was a pity to throw away the new dusters, and accordingly they were put into a closet for safe keeping. In the night the church was entirely destroyed by fire. The cloths in the closet had caught fire by spontaneous combustion.

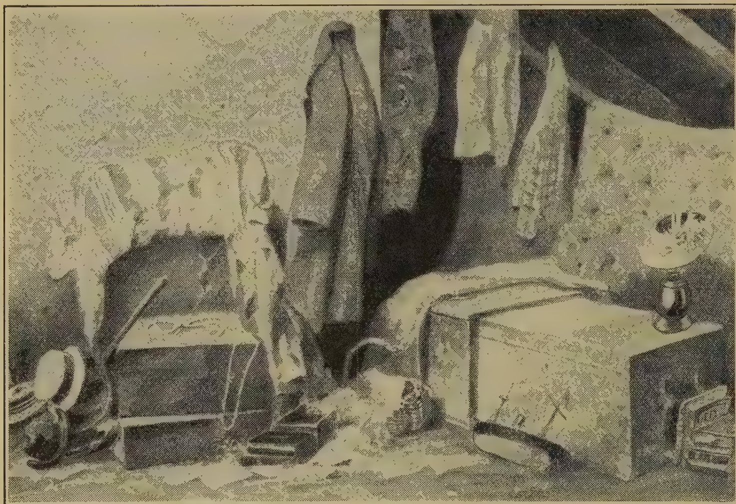
So remember that if you don't burn your rubbish it may suddenly start to burn all by itself and perhaps in the middle of the night.

Let me describe to you a beautiful home which



I know. Its lawns are rolled and clipped, its flower-beds are carefully tended, its gravel paths are smooth, it has a rosebush over the door and bright-colored awnings at every window, and yet the house is more dangerous to its neighbors than an enemy aëroplane dropping bombs. I had occasion to make an inspection there one day, and this is what I found:

In the cellar and under the porch were the barrels and packing-boxes that had been used when the family moved in. In the cellar were also the excelsior that came around the new parlor clock,



a few old chairs and tables, a disabled rocking-horse, and several boxes of magazines. In the garret were any number of old straw hats, two or three torn mattresses, a lot of old clothes hanging on hooks, two trunks full of old letters, and I forget what else. On the second floor I found that the lady of the house was keeping all her light summer dresses in a closet which had a steam pipe passing through it. In the yard, whoever had raked the lawn had piled up a big mound of leaves near the steps of the side door and had gone away. Dead leaves sometimes take fire from

spontaneous combustion, even if they do not catch fire from a match or from a spark.

Do you wonder that every time the gong rings in the engine-house I think of this building? I know that if it burns the whole block may burn with it, if there is a strong wind, and then people will blame the fire department for not being more efficient. It would be a good thing if these owners knew that rubbish is one of the twenty most frequent causes of fires.

Before you criticize the owner of this house too much, ask yourself the following questions about your own home:

1. Is there rubbish in my basement?
2. Is the basement cluttered up with old pieces of boards or with waste paper?
3. If there is kindling in the basement, is it piled up neatly in a place where it is not likely to catch fire?
4. If oiled mops or oiled rags are used in the house, are they kept in metal containers?
5. Are the closets neat?
6. Is there rubbish in the attic?
7. Are there piles of rubbish in the yard?
8. Is there rubbish in the garage or in any other building in the yard?

Always remember that a clean house seldom burns unless a dirty house sets fire to it, and by a "dirty" house I mean a house where useless junk of all kinds is preserved as if it were of the greatest value.

Also, don't forget that dirt and rubbish are frequently a source of disease. Rubbish piles are good places in which rats and mice may hide and build nests. Not only do rats and mice carry disease, but their nests are fine places for fires to start. From every point of view rubbish piles are wasteful, unsightly, and dangerous.

THINGS TO DO

1. Pretend that you are an inspector examining houses to see where there are dangers of serious fires. With your notebook in hand, inspect the house described in the lesson you have just read and list all the things you see which make the house a dangerous place from the firemen's standpoint.

2. Sometimes pictures give an idea better than words can tell it. Can you draw a picture or make a poster which will give the idea of this lesson in a way that will show how important it is?

Your picture should have a name which will attract attention. Use one of these, or make up your own.

STOP — LOOK — AND BURN UP YOUR RUBBISH

RUBBISH KEEPS THE HOME FIRES BURNING

WHICH WILL YOU HAVE — A BONFIRE OR A HOME FIRE?

STEP LIVELY — AND BURN UP YOUR RUBBISH

BURN YOUR RUBBISH BEFORE IT BURNS YOU

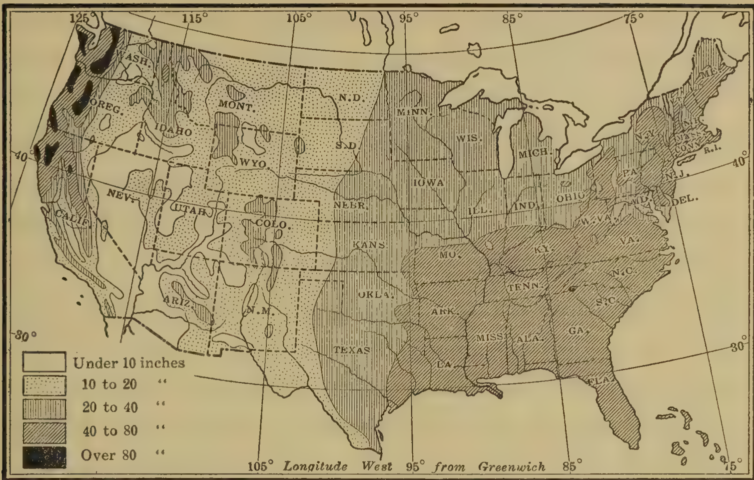
HOW TO READ A MAP

A good book is not of much use to us unless we can read it. And neither is a good map of much use to us unless we can read it and get from it the meaning for which it was planned. Reading maps is an important reading ability.

There are a number of maps in this book. Can you tell the real purpose of each one? What does the map on page 105 tell? Is the map on page 210 of the same kind? What does it tell?

At the top of the next page is another map. We may call it a rainfall map. Its purpose is to show how much rain falls in each part of our country every year. This purpose is explained by the words below the map. The line below a map is called the legend of the map. What words in the legend tell what country is shown in this map? What one word tells what part of our country's climate is shown? What word tells that we are to find out how much rain falls *every year*? What word tells us that it is not the rainfall for this year or for any particular year which the map shows, but that it is the amount we expect every year?

Read the legend of the map. What does this map tell?



AVERAGE ANNUAL RAINFALL IN THE UNITED STATES

Some maps tell their story in colors. Some tell it with lines running in different directions. This is called shading. The map we have in this lesson is a shaded map. In the corner of the map each kind of shading is explained. This explanation is called the key; with it we can unlock the meaning of the map.

In the key find the block which stands for regions where the average annual rainfall is less than ten inches.

Do you know what ten inches of rainfall means? Try to imagine a level field covered with water

ten inches deep. That would be all the water which that field would have during *the whole year* if its annual rainfall was ten inches. A land which has less than ten inches of rainfall each year is very dry. Some of it is desert. It could not be a great farming country unless some way were found to get water for the crops.

On the map find the regions which have less than ten inches of rainfall every year. Name the states which have such regions. Along the Western coast there are high mountains which keep the rain clouds from moving eastward. Because of this there is not much rainfall in these regions. Are there states east of the Mississippi River which have less than ten inches of rainfall every year?

In the key, what is used to show regions having from ten to twenty inches of rainfall every year?

It is usually considered that ordinary agriculture must have twenty inches of rainfall, though ten inches is sometimes enough if it comes when and where it is needed.

On the map find the regions which have from ten to twenty inches of rainfall every year. Name the states. Is this territory as great as that having less than ten inches annually? How far south

do these regions go? How far north? Are there Eastern states which average from ten to twenty inches of rainfall?

Using the key, locate the regions which have from twenty to forty inches of rainfall. In these regions you will find the great grain-growing states, for wheat grows well in places having from twenty to thirty inches of rain. Corn needs even more than this for a good crop.

Locate the regions having from forty to eighty inches of rainfall yearly. In what parts of our country are they? How are they shown? Name all the states in which there are areas having from forty to eighty inches of rainfall every year. Which great groups of states are in this class?

In these regions having from forty to eighty inches of rainfall are some very productive farm lands. Can you name some of their products?

Which states have eighty or more inches of rainfall? The winds of this section blow from the west across the Pacific Ocean, and they gather up an immense amount of vapor in their travels. As they rise in order to pass over the Coast Ranges the air cools and much of the vapor is turned into rain or snow, which falls on the ocean-side of these mountains.

HOW WELL CAN YOU READ THE MAP?

1. What is the average rainfall where you live?

2. What is the average rainfall around the Great Lakes?

3. What is the rainfall of the Rocky Mountains?

4. How does the rainfall of Florida compare with that of California?

5. How does the rainfall of Washington, D.C., compare with the rainfall of San Francisco?

6. Should you expect the Western prairie states to raise much corn?

7. What is the average rainfall in the Mississippi Valley states?

8. Which sentence is right?

   a. Most of the South Central states have more rainfall than the North Central states.

   b. Most of the Western coastal states have less rainfall than the Central states.

9. Which have the more rainfall, the Eastern coast states or the Central states?

10. Which has the more rainfall, New Orleans or Minneapolis?

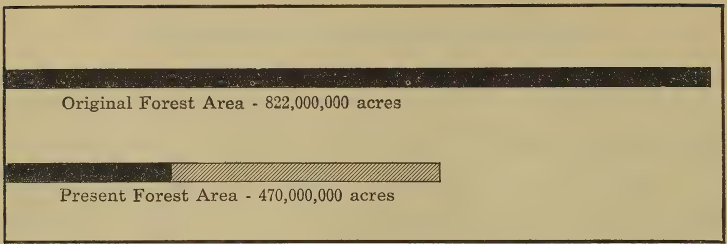
OUR NATIONAL FORESTS

[Of course you know how we got our national flag, and probably you know the story of the man who wrote our national song, but do you know how we got our national forests, why we have them, and of what good they are to us? The following article on "Our National Forests" will help you to find out about these things, will tell you quite a number of ways in which they are of value, and, besides that, will tell you how the forests are cared for. As you read, see how much you can find out about these two big questions:

1. In what ways are the national forests valuable to us?

2. How does the government take care of them?]

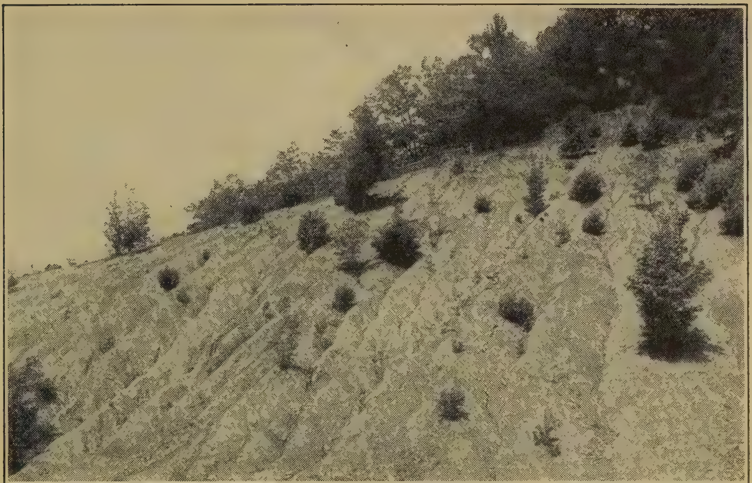
1. Early settlers in America found most of the land from the Atlantic to the Mississippi a vast unbroken forest. They had to cut trees for their buildings, and before they could plow the land and plant grain, the land had to be cleared. Miles and miles of woodland were burned off or the trees were cut down to make room for farms. As the pioneers moved westward the great hardwood forest of the Ohio valley was cut, not because



THE AMOUNT OF ORIGINAL FOREST AREA AND THE AMOUNT OF PRESENT FOREST AREA IN OUR COUNTRY. ONLY 138,000,000 ACRES OF THE PRESENT FOREST AREA ARE ORIGINAL FORESTS

lumber was needed, but because the land had to be cleared for farms. The lumber could not be shipped away because there were no railroads. Hundreds of maple and walnut logs which would be worth a great deal today were rolled together into piles and burned. The Southern forests were wasted, also. Not only was lumbering done very wastefully, but the turpentine producers were so careless in the way they obtained the turpentine that much of the Southern pine forest was destroyed. And so it went on until nearly half our forests were gone.

2. Besides furnishing lumber, the forests have another very important use. The underbrush, vines, creepers, ferns, grass, and leaf mold form a sort of sponge which holds water in the ground, and prevents it from running off rapidly after



A BARE HILLSIDE SHOWING THE RESULT OF CUTTING AWAY THE FOREST

Courtesy of the United States Forest Service

storms and causing floods in the valleys. In forest land the water slowly seeps through the soil and works its way to the streams, feeding them regularly throughout the year. But when the forests are cut off and there is nothing to hold the water, the streams become raging floods, washing away the loose soil from the hillsides and causing a great deal of damage. Then, when the flood is over, the water supply is gone and the stream bed is dry until the next storm causes another flood.

3. When people began to realize the effects of

cutting our forests so wastefully, they decided that the forests must be saved, not only that we should always have a supply of lumber, but also that the flow of our streams might be kept uniform for the use of water power, and valuable land would not be worn away by floods. For these reasons a law was passed in 1891 which gave the president the right to reserve, or set aside from sale, forest land which the government still owned. Since that time many of our best forests have been reserved, until now we have more than one hundred and fifty-six million acres of national forests, about one third of all the forests in the United States. Most of them are in the Rocky Mountain and Pacific Coast states, but there are some in the southern Appalachians and elsewhere, including parts of twenty-seven states.

4. These national forests are sometimes called Forest Reserves, since they were reserved, or set aside from sale; and the department of the government which is in charge of them is the Forest Service. In 1919 more than five thousand persons were employed in the Forest Service. Those who work in the offices in Washington make plans for the control of the forests, experiment with different kinds of trees, publish information and

OUR NATIONAL FORESTS

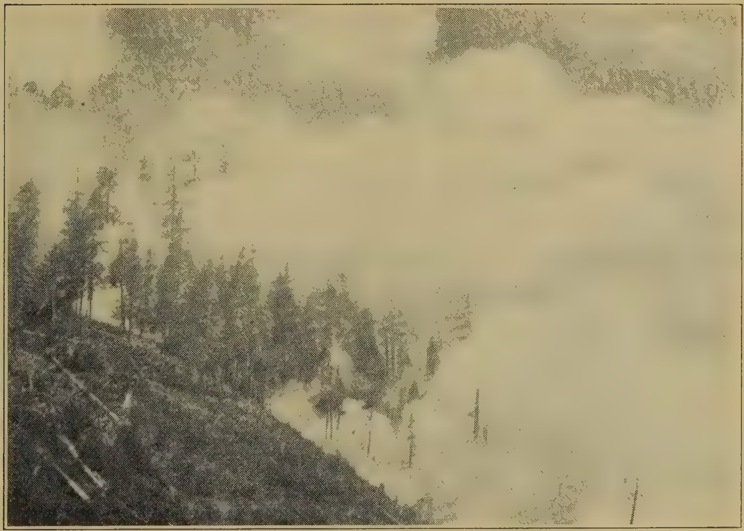
advice about caring for woodlands, and do many other things for the welfare of the forests. The men who work in the forests for their protection and care are called rangers. On them is the great responsibility of seeing that the national forests are well cared for and wisely used.

5. One of the duties of the forest rangers is to manage the sale and cutting of timber, allowing only the full-grown trees to be cut. The stumpage, or timber in standing trees, is sold to lumbermen, who come in and cut the timber which is marked for cutting by the rangers. In 1920 over three million dollars' worth of timber was

sold in this way. Besides being a source of income, this cutting of timber thins the forest and makes room for the growing trees.

6. After a piece of timberland has been burned or cleared by lumbermen, it is sometimes reforested, or planted over again to trees. Sometimes this is done by sowing the tree seed directly upon the ground. Most of the one hundred and thirty-five thousand acres which have been reforested have been done in this way, but some have been replanted with young trees, or seedlings.

7. In the national forests there is much farm and pasture land, and there are also valuable minerals. Mining companies are allowed to mine these minerals, and farm land is open to settlement. The pasture land is rented to sheep and cattle owners who live near the forests. Millions of cattle, goats, and sheep are pastured in the national forests, and several million dollars are collected each year from stockmen who obtain permission to pasture their stock there. The rangers are in charge of renting the pasture land, also. The money received from the sale of timber, the rent of grazing land, and the use of water power is used to pay the expenses of maintaining the Forest Service.



A FOREST FIRE
Courtesy of the United States Forest Service

8. The forests have to be protected from many enemies. Fire is their most dangerous enemy. Today many millions of acres of woodland have been wholly or partly burned. It is the work of the rangers to prevent and check fires. Many of the fires are caused by lightning. One storm may start from a dozen to thirty fires within an hour or two. The showers of sparks shooting from the smokestack of a fast train may do fearful damage. Or a camp fire left by careless picnickers may be fanned by the wind and fed by the

dry grass and brush of the forest until it spreads into great sheets of flame. The flame spreads to the leaves, the branches crackle, the great tree trunks burn and crash to the ground. The fire sweeps on for miles, a cloud of smoke and soot hanging over the forest. Fires like this cause a loss every year of nearly ten times the amount we can earn with our national forests.

9. In the summer, when the forests are dry, the chief duty of the rangers is to patrol them on the watch for fires. Men are stationed in high lookouts with telescopes to watch for smoke. As soon as a ranger sees a column of smoke which looks at all suspicious, he sends word by telephone, messenger, or signal to the nearest "smoke-chasers," as the fire-fighters are called. Sometimes the fire can be put out; but usually it can only be kept from spreading by very hard work, and is left to die out or to be put out by rain. Fires which burn along the ground may be stopped by digging deep trenches and thus holding them back until the flames die out. The usual way of stopping fires is by "back-firing." To do this, the rangers start another fire at some distance ahead of the raging forest fire. As the back fire burns, it burns up all brush and material which could be easily

AFTER THE FOREST FIRE WHICH WAS STARTED BY A CARELESS CAMPER

Courtesy of the United States Forest Service

caught by the main fire. When the two flames meet, they burn fiercely for a time, and then gradually die out for lack of material on which to feed.

10. During a forest fire the fire-fighters are organized somewhat like an army. There is the base camp where supplies and equipment are kept. The front-line fighters are the rangers. Behind them are the men who come to help in time of great need — logging crews who have come to harvest the ripe timber, miners, ranchers here and

there, and railroad crews. From the base camp to the fire lines pack trains take up the needed supplies. For good fire protection it is necessary that the national forests have roads and trails. The government sets aside a large sum every year for building more roads through our forests.

11. Of all animals, insects are by far the most dangerous enemies of the forests. They increase so rapidly that they do an immense amount of damage. Some of them eat the leaves and buds; some destroy young plants; some suck the juice, and thus injure the leaves and bark; some eat the young roots; and some bore through the bark and into the wood, and in this way spoil the wood for lumber. It is the work of the rangers to watch for signs of the presence of insects, and to destroy any growths on the trees which would make them decay. With the help and advice of the experts in the Forest Service at Washington, many insects and tree diseases can be wiped out.

12. Another duty of the rangers is to regulate the use of the national forests for recreation. Many of the most beautiful parts of the forests are being kept by the Forest Service for recreation grounds. There are more than ten thousand summer camping sites for rent in our forests, for

from ten to twenty-five dollars a year. Many of these are close to fishing, hunting, and wonderful scenery. A summer home site may be leased, or rented, for a number of years, and then when the time is up, it may be leased again, so that a person is always able to keep his own cabin, although he cannot buy the land. Nearly two million people use the national forests for recreation every year.

13. At first, many persons did not think it was right to set aside the best forests from sale. They thought the people of the country would get no use of the forests. But now most of us realize that the country as a whole gets much more use of the forests under government management, and, further, we are sure that the forests and their benefits will be made lasting for the American people.

MEMORY TEST LESSON

Take a sheet of paper, put your name on it, and start work on this outline.

I. How the national forests are of value to us

A.	*F.*
B.	*G.*
C.	*H.*
D.	*I.*
E.	

II. How the national forests are cared for

A. What is done in the government offices for their care

1.
2.
3.

B. What is done by the rangers in the forests

1.
2.
3.
4.
5.
6.
7.

FILLING IN AN OUTLINE

In the lesson you have already done on "Our National Forests" you made a very short outline from memory. In this lesson you are to make a very much longer outline, using the reading material constantly to give you the answers.

There is a total of 25 points. How many can you find?

I. Who reserved the national forests?

II. Where are they?

A.
B.
C.

III. What part of the government takes care of forests?

IV. Why are trees in the forests cut?

A.
B.

V. How is timberland reforested?

A.
B.

VI. What occupations are carried on in the national forests?

A.
B.
C.
D.
E.

VII. What ways of stopping forest fires are described?

A.
B.

VIII. Name some ways in which our forests were wasted:

A.
B.
C.

IX. How much of our forests in the United States are national forests?

X. Why are the national forests good places in which to spend vacations?

A.
B.
C.
D.
E.

IN A NATIONAL FOREST[1]

[This selection you are about to read is an account of an imaginary trip taken by a group of boys and girls through one of the national forests in the Cascade Mountains. On their trip they meet and talk with a forest ranger and with a cowboy who is in charge of a herd of cattle in the forest. The ranger and cowboy both tell something about the work of forest rangers and the value of our national forests.

You have already read an account of conservation in our national forests. But there are some new ideas given in this one. Take a sheet of paper now, and, as you read, jot down all the *new ideas* about the national forests which you receive from this selection. When you have finished you may compare your list with the lists of other members of the class.]

"My job? Well, it's a fairly husky job. I have charge of about a hundred thousand acres, which is called a district, and over me is the supervisor, who has charge of the whole forest. I live in the woods most of the year, in a little cabin which

[1] Overton W. Price, The Land We Live In (Adapted).

A FOREST RANGER
Courtesy of the United States Forest Service

the government built. I hope you will eat supper and sleep there tonight."

"But what kind of work do you do in this great district?" we ask the forest ranger.

"It is part of my duty to see that fires don't get into my district," says the ranger. "Every day during the fire season, which lasts from about May until late in the fall, I ride the trails on the lookout for fires. If I see one I have to drop everything else and hike for it, which may take a couple of days, for one can see a great way off in these mountains, and the going is hard. Then I have

SHEEP GRAZING IN A NATIONAL FOREST
Courtesy of the United States Forest Service

to look after timber sales, for the government is selling timber here, and it has to be cut carefully so as not to injure the forest.

"I have to watch the sheep and cattle which are grazed in the forest, and see to it that they are kept in the territory assigned to them, and that the pasture land is not overgrazed."

We are thinking that the ranger has his hands full if he does all these things, but he goes on:

"There are many other things. If anybody wants to use anything in my district for any pur-

pose, — and the government encourages the use of this forest in every way which will not destroy it, — I go over matters with him on the ground and give him a permit. Some people want to settle in the forest, like the rancher back there in the valley, and I have to find out whether the land will really make a good farm, or whether it is so poor that it ought to stay under forest. People want land for camp sites, or to build stores on, or for mines, and for many other uses. Some want to buy timber to saw up and sell, while many more want a little timber merely for their own use — and this the government gives them, just as it lets the settler's cows graze without any charge. There are water-power men who want to run pipe lines, and to build plants and develop power from the rivers in the mountains. These are some of the things, but there are many more."

We chat a few moments with a cowboy in charge of a big bunch of cattle, who looks much like our ranger, except that he wears a different kind of clothes. He doesn't seem to have any grudge against the national forest.

"In the old days, before these national forests were made," he says, "the sheepmen and the cattlemen were always quarreling over which

should have the range. Often sheep and cattle do not do well on the same ground; cattle do not like to graze where sheep have been, for the sheep graze so close that they leave very little forage behind them.

"Now it is all different. The Forest Supervisor runs this range, and he runs it right. He puts the cattle on the lower slopes, where they belong, and he puts the sheep on the higher ranges, where they do best. The result is that everybody gets his share, and the range is getting better all the time.

"That isn't all the Forest Service is doing for the cattleman and the sheepman. It is trapping and shooting the wild animals which make trouble for the sheep and cattle — the wolves, the bear, the coyotes, and the mountain lions. The rangers kill some of them, but the Forest Service also hires hunters who do nothing else. Every wolf or lion killed is worth a hundred dollars to the stockmen; for if he lived he would cost as much as that every year in sheep and cattle destroyed."

We leave the cowboy reluctantly, for, like the ranger, he knows his business.

CORK, A USEFUL MATERIAL

Does your penholder have a cork grip? Does your fishing line have a cork bobber? What other things have you seen that are made of cork? The articles shown in the picture on page 121 are all made of cork. Can you tell why each of these things is made of cork?

An old ballad of the twelfth century contains these lines:

> Our Scots nobles were right laith [unwilling]
> To wet their cork-heeled shoon [shoes].

From this we know that cork was used at least eight hundred years ago.

The lesson "Raw Cork" tells many interesting things about this useful material. Finding the answers to the questions on page 120 will help you to remember the important points.

Read the first question, then turn to the lesson and find the answer.

Read the second question and find the answer to that question. When you have found the answers to all of the questions, measure how well you read and how accurately you remember important points by doing the exercise which follows the lesson.

THE QUESTIONS

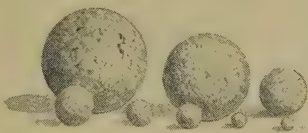
1. What is cork?
2. Where does cork come from?
3. How long ago did man first make useful things of cork?
4. Is cork still used for these same purposes today?
5. How is raw cork prepared for use?

RAW CORK

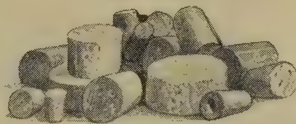
Every boy and girl has seen corks which are used as stoppers for bottles. There are corks of various sizes, from the very tiny size that is used in perfume bottles to the very large size that is used in jars. The smallest size, usually found in a drug store, is about one fourth of an inch across. The larger corks, used in pickle jars and in vacuum bottles, may be as much as three inches across.

Some stoppers are made of glass and some of rubber, but most bottle stoppers are made of cork. The name *cork* is used not only as the name of the material out of which stoppers are made but also as a name for the stopper itself.

Why do you think cork is so much used in

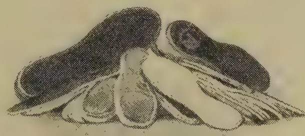


Cork balls

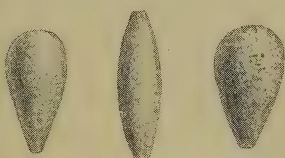


Bottle stoppers

Cork polishing wheels

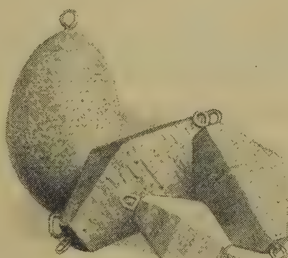


Cork insoles



Bobbers

Instrument and fishing-rod handles



Mooring and anchoring buoys

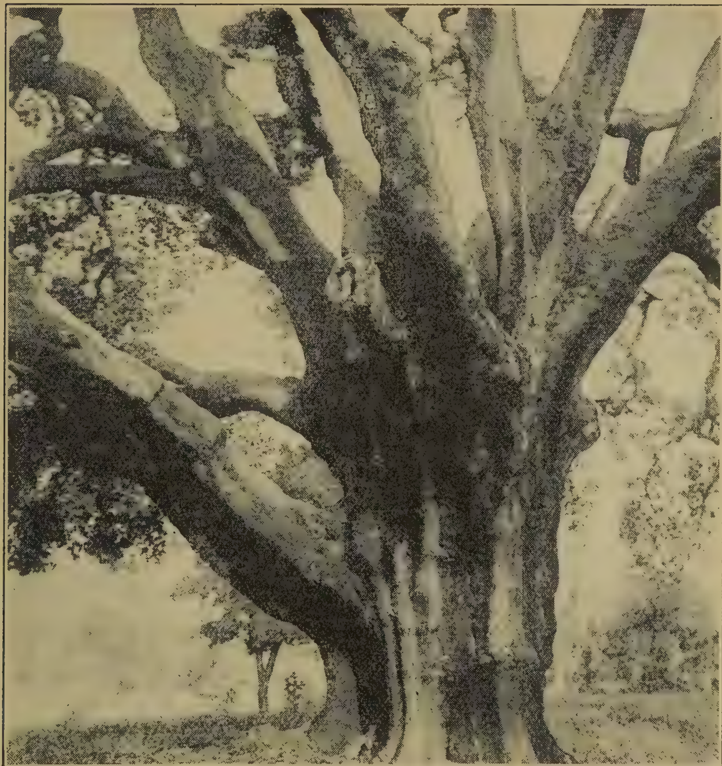
Cork paper

making stoppers for bottles? It is because cork is elastic, so that when it is pushed into the neck of a bottle it contracts as it goes in and then expands. This makes it fit the neck of the bottle so tightly that the liquid will not run out. Cork is also tough and very light. It does not soak up water as does wood, and it is a nonconductor of heat and cold; that is, heat and cold do not pass through it readily.

For these reasons cork is a useful material for many other things besides bottle stoppers.

Thousands of pairs of cork insoles for shoes are used every year. Thin disks of cork line the metal caps of many bottles and jars; rings of cork make churn lids fit tightly. Cork wheels polish the glass in glass factories; cork buoys mark the channels in streams. In tropical countries a helmet lined with cork protects the wearer from sunstroke. Cork is used to make the centers of baseballs; buttons on fur coats have cork centers. Even the animal heads on rugs and on fur garments may be cork shapes covered with fur.

Five of the most important purposes for which cork is used today were known in the world two thousand years ago. A Greek writer tells us that in ancient times a messenger floated across a



GNARLED TRUNK OF AN OLD CORK TREE [1]

river on pieces of cork. Today cork is used in making life-preservers. The fishermen of ancient Greece and Rome buoyed up their nets with cork floats, just as fishermen do today. The Romans

[1] This picture, and those on pages 126, 127, 128, 136, 137, and 139, are reproduced by permission of the Armstrong Cork Company.

used cork as stoppers for jars and casks, as buoys for the ropes of ships' anchors, and as a material for the soles of women's winter shoes.

Cork comes from the bark of the cork oak tree, which grows principally in Spain, Portugal, and northern Africa. The corkwood is the outer bark of the tree. Most trees cannot lose much of their bark without dying; but the cork oak has two layers of bark, so that the tree is still protected even when the outer layer is stripped off. The outer bark soon grows again unless the inner bark is injured.

The first cork is stripped off when the tree is about twenty years old. This first crop is so rough and coarse that it is worth little. The tree does not begin to yield the best bark until it is about forty years old. After the first stripping, the bark is cut about every nine years. Most of the trees live to be a hundred years old. Some trees have been known to live two hundred years or more.

The Spanish method of stripping the bark is the one most commonly used. In Spain the men who strip the bark use hatchets with long handles which are wedge-shaped at the end. A cut is made through the bark around the base of the

REMOVING THE CORK BARK
Courtesy of *Nature Magazine*

tree. A second cut is made around the trunk just below the place from which the main branches spring. The two circles are now connected by one or two long, lengthwise cuts, which follow so far as possible the natural cracks in the bark. The wedge-shaped handle of the hatchet is slipped into

PREPARING CORK FOR CARRIAGE TO A BOILING-STATION

these cuts and the bark is pried off. Great care must be taken not to injure the inner skin. For this reason only skilled workers are allowed to strip the corkwood. The larger branches are stripped in the same way. They usually yield a thinner but finer grade of cork than that taken from the trunk.

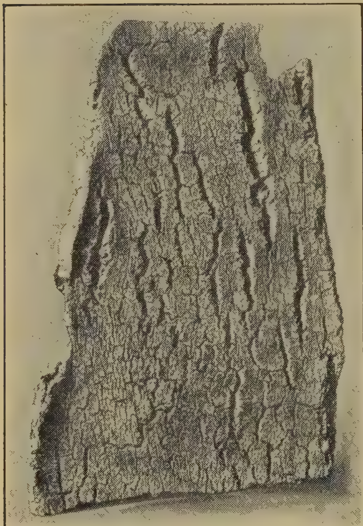
After drying for a few days, the bark is taken to boiling-stations. Here it is stacked and allowed to season for a few weeks. If the forest is far inland, and there is plenty of water and a good

A CORNER OF THE SORTING-ROOM AT THE SEAPORT

supply of bark, the boiling-vats are built in the forests. Sometimes the boiling is done after the bark has reached the place from which it is to be shipped to the cork factories of the world.

Boiling the bark does three things. It removes the tannic acid; it softens the rough, useless outer coating so that it can be scraped off; and it flattens out the bark so that it can be more easily shipped. After being boiled and scraped, the bark is ready for its journey from the forest to the seaport from which it will be shipped.

The forests are generally located in hilly or



PIECE OF CORKWOOD

BALE OF CORKWOOD

even mountainous country, where the roads are poor. Consequently the corkwood usually has to be carried to the nearest railway station on the backs of sure-footed burros. These patient little animals are a funny sight when loaded from head to tail with a huge mass of the light bark. Long trains of burros, thirty, forty, or even a hundred in number, wind in single file down the narrow, rocky paths, carrying their valuable loads.

At the seaport the rough edges of the cork-wood are trimmed, and it is sorted into a dozen

or more different grades as to quality and thickness. Some of the corkwood is only half an inch thick, while some is as much as two and a half inches thick. Some of the strips are of finer grain than others, so the strips have to be carefully sorted.

When the cork has been sorted, it is baled in machines which press the sheets down tightly and bind them with steel hoops or wires. The grade or quality of each bale is carefully marked on it. The corkwood is now ready to be shipped to the cork factories of the world.

HOW CAREFULLY DID YOU READ?

Without looking back at the lesson, see how many of the questions on page 130 you can answer. Copy the numbers of the questions you can answer on a sheet of paper. Draw a line across the paper below these numbers. Now turn back to the lesson and read to find the answers to the questions you have not already answered. As you find the answer to each of these questions, copy its number below the line on your paper.

THE QUESTIONS

1. How long has cork been used?
2. What five purposes for which cork is used today were known by the Greeks or the Romans?
3. In what countries is the cork oak tree most abundant?
4. Why does the cork oak not die when the cork bark is stripped off?
5. How old is the cork oak before the first cork is stripped off?
6. When does a cork oak begin to yield the best bark?
7. How old do most cork oak trees live to be?
8. Describe the Spanish method of stripping the bark.
9. Why are only skilled workers allowed to strip the cork bark?
10. What three things are accomplished by boiling the bark?
11. Under what conditions is the boiling done in the forest?
12. Why is the bark carried to market on the backs of burros?
13. How thick is the corkwood?
14. Why must corkwood be sorted?

CAN YOU TELL WHY THESE THINGS ARE MADE OF CORK?

Why are most bottle stoppers made of cork? Can you tell other reasons why cork is a useful material? Turn back to page 122 to see if you have forgotten any of the qualities which make cork useful for so many purposes.

In as few words as possible, tell for which of these reasons cork is a suitable material out of which to make each of the following things:

1. Bobbers for fishing lines
2. Life-preservers
3. Sun helmets
4. Buoys
5. Insoles for shoes
6. Fishing-rod handles
7. Lining for the walls of ice plants
8. Centers for baseballs
9. Floor covering for hospitals and other public buildings
10. Lining for the metal caps of bottles and jars
11. Covering for cold-pipe lines
12. Wheels for polishing glass
13. Handles for surgical instruments

ARRANGING THE STEPS IN A PROCESS IN ORDER

The lesson "Raw Cork" told how cork bark is prepared for shipment to the cork factories of the world. On page 133 is a list of the steps in the process of preparing cork bark for shipment. But these steps are not listed in the order in which they are carried out. Show the order in which the steps should be listed by writing on a sheet of paper the numbers of the steps in the order which is followed in preparing cork for market.

What is the first step? The step which is numbered 1, *Scraping off the useless outer coating*, is not the first thing to be done in preparing cork for market. Read down the list until you come to the step which tells what is done first. Number 4, *Stripping the bark*, is the first step in preparing cork for shipment, so the first number in your list should be 4. Number 3, *Drying the bark in the forest*, is the second step in preparing cork for shipment, so the second number in your list should be 3. Write the numbers in a column like this:

4

3

Arrange all the numbers in the right order.

PREPARING RAW CORK FOR SHIPMENT

1. Scraping off the useless outer coating
2. Baling the sorted cork
3. Drying the bark in the forest
4. Stripping the bark
5. Seasoning the bark at the boiling-station
6. Marking the grade on the bale
7. Carrying the bark to the boiling-stations
8. Boiling the bark
9. Sorting the bark into grades
10. Transporting the bark on the backs of burros to the nearest railway station
11. Trimming off the rough edges

SELECTING THE STEPS IN A PROCESS

Can you tell clearly and briefly how something is made or how a product is prepared for market? You often need to do this in geography or history lessons. Have you ever had to tell about topics much like those which follow?

How wheat is grown and harvested

How raw rubber is prepared for shipment

How paper is made

How the colonial housewife prepared raw wool for spinning

A good plan to follow in preparing a report on such topics is to select the steps in the process of making or preparing the product. For instance, if you wished to report *How sugar cane is grown and harvested in the Sugar Islands*, you might set down these steps in the process, to guide you in giving your report:

How sugar cane is grown and harvested in the Sugar Islands

1. Preparing the fields for planting
2. Planting the sugar-cane stalks
3. Weeding the young cane
4. Cutting the cane
5. Hauling the cane to the mill

You will notice that all the steps are stated in the same form. It is not necessary to use the "ing" form, but all the steps must be alike. The first step might be set down like this:

1. Prepare the fields for planting

How would the other steps then be stated?

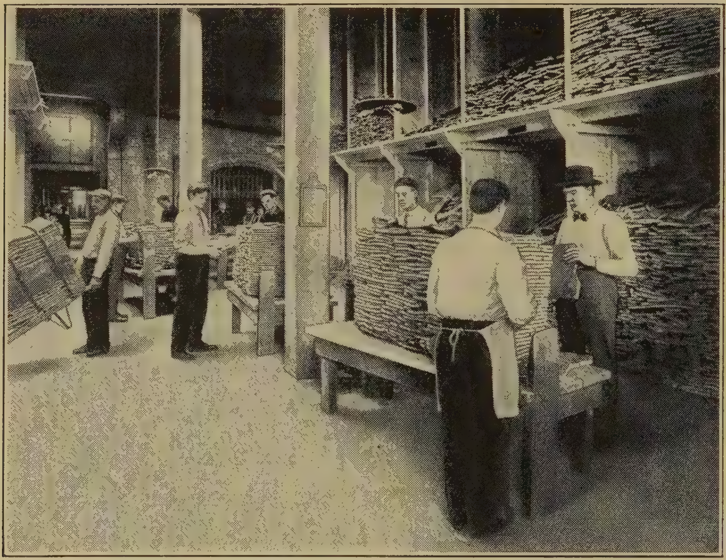
The next lesson tells how bottle stoppers are made from slabs of corkwood. Select the steps in this process so that you can tell clearly and briefly how bottle stoppers are made.

Read the lesson straight through to get the story as a whole, then go back through the lesson and set down the steps through which cork bark passes in being made into bottle stoppers. As you work, ask yourself the questions: What is done first? What is done next? etc. Write the steps in a column on a sheet of paper.

When your list is complete, try to tell about each step. Turn back to the lesson and read again about steps which you do not remember very well.

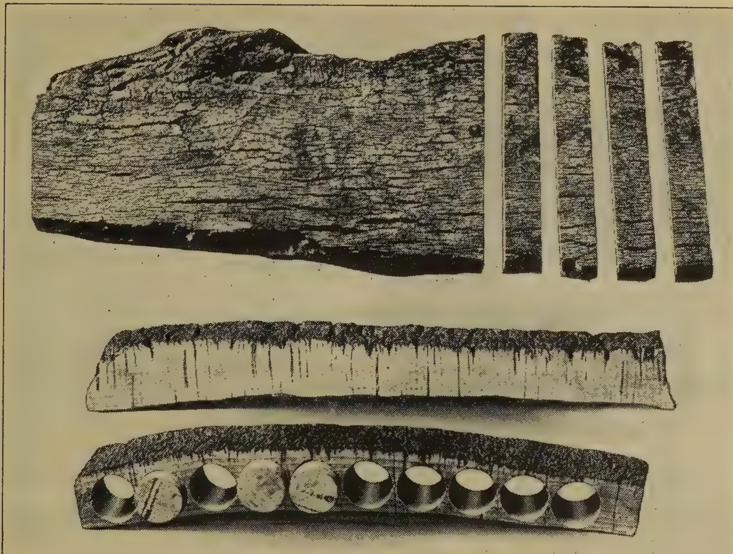
HOW BOTTLE STOPPERS ARE MADE

Which of the uses of cork do you think is most important? More corkwood is used for bottle stoppers than for any other purpose.



SORTING CORKWOOD AT THE FACTORY

For whatever purpose the corkwood is to be used, it must first be sorted. You remember that the grade and quality of each bale of cork was marked on it at the seaport where it was baled. At the cork factory, the bales are broken open and the corkwood is re-sorted. Skilled workers can sort the corkwood into as many as one hundred and fifty classes. The coarser material is later made into such articles as keg corks, jar corks, soda corks, and life-preservers. The finer cork is made into stoppers for medicine bottles.



(ABOVE) SLICING CORK INTO STRIPS; (BELOW) CORKS PUNCHED FROM STRIPS

In making corks, the slabs of corkwood are first softened by steaming, and then are cut into strips by circular steel knives. This soft, springy material is very hard to cut. The knives which cut the cork are kept as sharp as a razor and work so fast that they do not seem to move at all. Some of the finest cork can be sliced into sheets so thin that five hundred of them measure but one inch in thickness.

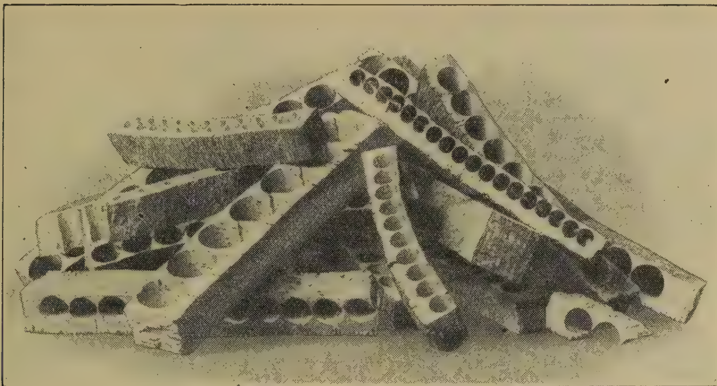
Corks are punched out of the slices of cork bark

in much the same way that cookies are cut from a piece of dough. The machine which punches out the corks works with great speed. The corks must be cut out as closely together as possible in order to avoid wasting the material.

The corks which are punched from the strips of corkwood are the same size at both ends. If corks larger at the upper end than at the lower are desired, they must pass against another very sharp knife. This knife tapers the corks by paring off a delicate shaving from one end.

Not all corks are made by being punched from strips of bark. Sometimes the strips are cut into small blocks which are rounded into corks. This work is done by hand or by machines. In Spain many corks are still made by hand. Whole families take part in the work of slicing the bark, cutting it into squares, and rounding the squares into bottle stoppers.

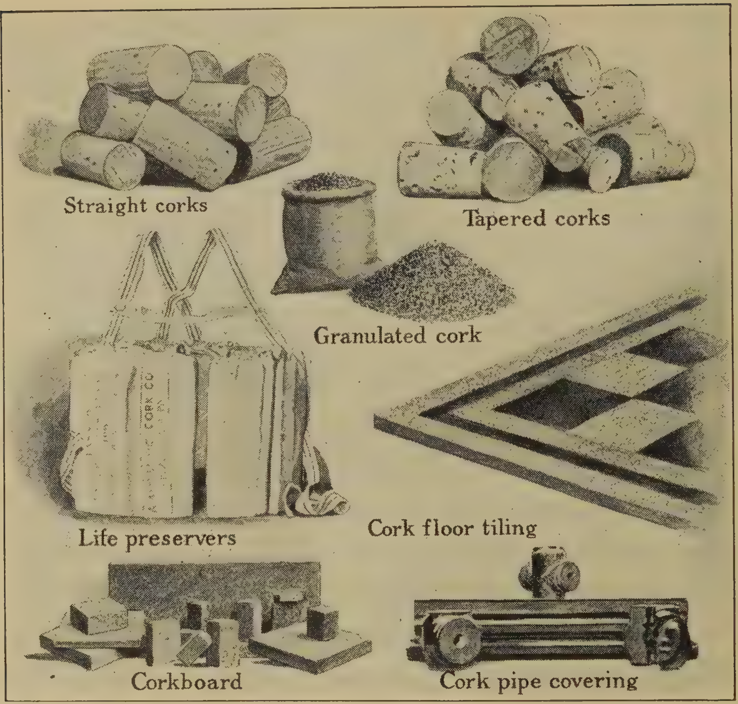
The finished corks are washed in great tanks, thousands at a time. They are dried by being whirled about in big revolving cylinders of wire net. The clean corks are sent to the sorting rooms, where they are sorted into different sizes and grades. A skilled worker can sort thirty-five thousand corks in a day.



CORK WASTE

The picture shows the strips of cork from which bottle stoppers have been punched. You can see that these strips contain much cork. What is done with this left-over material?

A great deal of scrap material is left over in cutting bottle stoppers. The strips from which the stoppers have been punched and the shavings from the tapered corks make up more than half the material that first started through the machines. A great many scraps are left, also, from the cutting of insoles, buoys, bobbers for fishing lines, and the many other articles made from cork. This left-over material is called cork waste, but not even the smallest scrap is really wasted.



Some of the cork waste is cut up into fine shavings and used to stuff mattresses and boat cushions. Cork shavings are also used to pack china, eggs, and other articles. Perhaps in a fruit store you have seen white Malaga grapes which were sent from Spain packed in cork shavings.

Part of the waste is ground up in a mill. This ground cork is used for many purposes. It is

packed between the walls of ice boxes, water coolers, and cold-storage rooms. Cork board, made from ground cork, is used to line the walls of ice plants, creameries, and dairies. Even cold-pipe lines are covered with cork pipe made from ground cork. Floor tiling, made from ground cork, is used in hospitals, hotels, and libraries.

Cork flour, a very fine quality of ground cork, is used to make a number of useful things. Perhaps you have linoleum on your kitchen floor. That is made from cork flour.

Parings of cork are burned and made into a beautiful and lasting paint used by artists.

In our country, millions of dollars' worth of cork products are manufactured every year. We import more raw cork than any other country. Much of this comes from Spain and Portugal.

CLASSIFICATION TEST

Across the top of a sheet of paper write these words:

cork shavings   ground cork   cork flour   parings of cork

Under each word list all the articles you know which are made of this kind of cork waste.

MAKING A GRAPH

Our country has the greatest wheat fields in the world. Every year our crop amounts to about one quarter of the world's product.

This is an interesting thing to know; we should know how our country ranks with other countries in producing some of the things people need. But sometimes sentences like these can be understood better if there is a picture of the meaning. See if you can make a picture of these sentences.

1. In the first place, put at the top of your paper *United States' Part in the World's Wheat Crop.* Using a ruler, draw across your paper a line four inches long. One eighth of an inch directly below this, draw another line four inches long. Connect the ends of these lines by short up-and-down lines. This makes a bar. Divide this bar into four equal parts by a heavy line across the bar at one inch, two inches, three inches. Fill in the bar lightly with a pencil or crayon. Beside this bar print lightly *The World's Wheat Crop.*

Now directly below this bar make another exactly one inch long. Fill this in as you did the other. Beside this bar print lightly *United States' Wheat Crop.*

By means of these bars you can quickly see a picture of the statement: "Our crop amounts to about one quarter of the world's product."

This is called a bar graph.

2. In the same way, from the following statement, show how much of the world's corn crop is raised in our country.

We raise about four fifths of the world's crop of corn.

Remember that when you showed "one quarter," you made one line four inches long and the other just one inch long. How long will the lines be to show four fifths?

Print beside one bar *The World's Corn Crop.* Print beside the other, *United States' Corn Crop.*

Can you make bar graphs for these sentences?

1. About one fourth of the world's supply of iron ore comes from the region around Lake Superior.

2. The United States uses one fifth of all the world's sugar crop.

PROVING YOUR ANSWER

In this lesson you will find a list of questions about the national forests. You are to answer each question with Yes or No and give the *exact* words from the article on "Our National Forests" which prove your answer. Here is an example. Is the answer Yes or No?

Were the forests of the Ohio valley hardwood?

In the first paragraph of "Our National Forests" you will find that the fourth sentence tells about the great hardwood forest of the Ohio valley. Turn back and find it. This sentence proves that the answer to this question is Yes. This is the way to show the answer:

Yes. " . . . the great hardwood forest of the Ohio valley."

We might have written the whole sentence, but these few words are enough to prove our answer. Write either Yes or No for each question, and after it the words which prove your answer. Write as few words as possible.

Take a sheet of paper; write your name on it. Be sure to number each answer.

1. Are our national forests all in the West?

2. Do the rangers cut and sell the timber in the national forests?

3. Do fungi spoil a tree for lumber?

4. Are insects the forests' most dangerous enemies?

5. Does the Forest Service help those who own forests to care for them in the right way?

6. Were the national forests made from forest land which the government still owned?

7. Can burned-over timberland ever be forest again?

8. Do insects kill the tree and spoil the wood for lumber?

9. Has lumbering always been very carefully done in our country?

10. Do more than half the states have some national forests?

11. Do forests help to prevent floods?

12. May anyone but the rangers live in the national forests?

DO YOU KNOW THE ANSWERS?

We like pink roses, yellow daffodils, and the glowing colors of the sunset. We like blue books, red sleds, and red balloons. We like our clothing to be red, blue, green, brown, and many other colors.

Where do we get the colors which make our clothing attractive? Can you answer any of these questions?

1. What were the first dyes with which man colored his clothing?
2. How old is the art of dyeing?
3. What was Tyrian purple? Why could only kings and the very wealthy wear Tyrian purple?
4. In early times what was used to dye cloth blue? "Turkey red"?
5. What dye materials were given to the world by the discovery of America?
6. How is dye made from the bodies of tiny insects which live on cactus plants?
7. Where did the colonial housewife in America get the colors with which she dyed the wool and the cloth she spun and wove?
8. From what materials could she obtain each of the following colors?

crimson	black
brown	orange and yellow
green	light purple

9. What are aniline dyes?

10. What changes have been made in the dye industry by aniline dyes?

11. How does the cost of aniline dyes compare with the cost of dyes made from natural dyestuffs?

12. How does the number of colors we can have now compare with the number before aniline dyes were discovered?

13. Why can cloth which contains both cotton and wool not be dyed at one operation?

14. How did the World War affect the dye industry in our country?

15. What industries use most dyes?

You will find the answers to these questions in the next lesson. Read carefully straight through and then turn back and answer as many questions as you can.

When you have done this, read the lesson through a second time to see if you can find more ideas about each question.

THE STORY OF DYES

Have you ever stopped to think how much we all enjoy color? We like to see in our clothing, our books, our pictures, and our toys the same lovely colors with which the buds, the flowers, and the butterflies are dressed. Even in savage times man colored his dress with dyes which he obtained from plants and animals. At first these colors probably faded very quickly, for they were merely the juices of fruits, leaves, and flowers. In time methods of making the colors lasting or fast were discovered. Then the art of dyeing really began.

Dyeing is one of the most ancient of the arts. It was well understood centuries before Christ was born. Many of the materials and methods which the ancient Egyptians used are still in use today. Although many dyes were made from plants and animals, dyes which gave bright, beautiful, and lasting colors were few in number. Many of these were rare and very expensive.

The most precious of ancient dyes was Tyrian purple, really a bright crimson, which colored the robes of ancient princes and, later, of Roman emperors. A thousand years before Christ, the

city of Tyre became famous for its purple dye. The dye was made from shellfish found in the Mediterranean Sea. From a tiny sac behind the head a drop of thick, whitish liquid, smelling like garlic, was obtained. This liquid, when spread upon cloth and exposed to air and sunlight, turned first green, next blue, then purple. If the cloth was washed with soap, it became a fast crimson. It took thousands of shellfish to make a small quantity of dye. This made the dye so expensive that only kings and the very wealthy could wear robes of Tyrian purple. At one time a Roman emperor fixed the price of wool dyed Tyrian purple at $350 a pound. Linen which was crimsoned with this rare dye cost $600 per pound.

Another much-prized ancient dye was indigo, a beautiful, fast-blue color made from the indigo plant. In the tombs of Egyptian mummies are found wrappings of cloth dyed with indigo, which have kept their bright blue color unfaded through the centuries. Indigo and many other of the best dyes came from India.

The use of the madder root to dye "Turkey red" was known from the earliest times. Cloth dyed red with madder has been found in the tombs of Egyptian mummies. The madder plant

was originally cultivated in India and in southern Asia, but it was later introduced into France and Holland, where it became a very profitable crop. It was grown to some extent in America in colonial days.

The discovery of America gave the world many new dyestuffs. Many of these were made from the wood of tropical trees. Logwood and brazilwood were among the most important of the dyewoods. These woods were combined with other substances to make yellow or red. The bark and sapwood of the logs were scraped off, and the heartwood shipped to market in large blocks.

The Spanish explorers found the natives in Mexico and South America making a crimson dye from the bodies of tiny insects which live on certain kinds of cactus plants. This dye, called cochineal dye from the name of the insects from which it is made, was introduced into Europe by the Spaniards. It became an important article of commerce and is still used for some purposes. Today there are in Mexico large plantations where the insects are cultivated as carefully as are silkworms. Only the female insects are used to make the dye. The insects are brushed from the branches of the cactus into bags, and killed

by being dipped into hot water or put into a hot oven. They are later dried thoroughly in the sun. It takes seventy thousand of the dried insects to weigh a pound.

In colonial times in America, each housewife dyed the wool or the cloth she spun and wove. For her colors she depended for the most part upon the trees, flowers, and vegetables which grew in the neighborhood. Pokeberry juice boiled with alum gave a beautiful crimson. Sweet apple bark and sassafras bark, the root of the barberry, the flowers and leaves of the balsam tree, and a number of other flowers and roots were used for dyeing orange and yellow. From the bark of the red oak or hickory were made pretty shades of brown. Onion skins and walnut shells also dyed materials brown. A number of bright colors were obtained from flowers. The petals of the iris gave a delicate light purple tinge to white wool. Juice pressed from the flower of the goldenrod and mixed with indigo made a lovely green. A good black was made by boiling woolen cloth first with leaves of the common field sorrel, and then boiling it a second time with logwood and other materials. A black, made from the leaves and berries of the gall berry bush, was much used by hatters.

WHAT COLORS DID THE COLONIAL HOUSEWIFE MAKE FROM THESE TREES AND FLOWERS?

Only a few dyes had to be purchased by the colonial housewife. The leaves, bark, flowers, and roots which she gathered, and the madder which she raised in the kitchen garden, gave her most of the colors she used. Of the few dyes which were sometimes purchased, logwood and indigo

were the most important. Blue was the favorite color, and this was dyed with indigo. So popular was this dye that indigo-peddlers traveled over the country selling it.

In our country today the housewife no longer dyes wool or cloth, just as she no longer spins and weaves the cloth. All these processes are carried on in factories. These factories do not depend upon trees and flowers for their colors as did the housewife, nor do they use to any great extent the natural dyestuffs so prized by weavers a century ago. The dyes used in the modern factory are made from coal tar and are called aniline dyes.

Aniline dyes have made a great change in the dye industry. Although they were not discovered until the latter half of the nineteenth century, they have already replaced almost all the old dyes, many of which had been in use for centuries. Before chemists discovered that dyes could be made from the coal tar which had been wasted, we had to depend upon plants and animals for our colors. To obtain them we robbed nature in all parts of the world. Since the discovery of aniline dyes, we no longer have to depend upon nature for our colors. In 1897 nearly a million

acres of land in India were growing indigo; today only a few hundred acres are planted to indigo. Before the discovery of a coal-tar substitute for madder, France produced half a million tons a year; today the madder fields of France have been planted to other crops.

This change has come about because all the colors which were made from natural dyestuffs can be made much more cheaply from coal tar. A hundred years ago indigo cost $4 a pound; in 1914, after the process for making artificial indigo was worked out, indigo cost about 15 cents a pound. The precious Tyrian purple which only princes could afford to wear can now be duplicated so cheaply from coal tar that anyone can wear the royal color.

Not only can the colors which formerly were obtained from natural dyestuffs be made much more cheaply from coal tar, but new shades and tints which were not possible from natural dyestuffs can now be made. Moreover, the aniline dyes contain fewer impurities than dyes obtained from plants and animals.

Another reason why the coal-tar dyes are valuable is because they give colors which can be used with various kinds of materials.

Dye acts in different ways on different materials. Some dyes which will color one material will not color other materials. Silk and wool are more easily dyed than cotton and linen. Cloth which is made of two materials, such as cotton and wool, cannot be dyed at one operation, but must be put through two dyeing processes.

The manufacture of coal-tar dyes became an important industry in our country during the World War. Before the war Germany was the greatest producer of these dyes. When the war cut off the German supply, dyes which had cost $1 a pound jumped in price to $34 and $48 a pound. One keg of dye which ordinarily cost $15 was sold for $1500. Then American manufacturers began to make dyes. Now the United States not only supplies its own needs but also exports more dyes than it imported before the war.

More than half the dyes which our country manufactures and imports are used by the textile industries. The leather, paint, paper, and ink industries use most of the remaining half.

MATCHING PARAGRAPH HEADINGS

Below are thirteen paragraph headings for the thirteen paragraphs in the lesson "Our National Forests." But these paragraph headings are not in the right order. You are to read each paragraph in the lesson in order and decide which paragraph heading below is the right one for that paragraph. For instance, the first paragraph tells how our forests have been wasted. Paragraph heading *g* is the right one for this. You may show your answer in this way: 1. *g*.

Now do the same for all the paragraphs.

a. How fires are stopped
b. The forests as stream regulators
c. Income from the national forests
d. The care and control of the national forests
e. The forests' insect enemies
f. Lumbering in the national forests
g. How our forests have been wasted
h. Danger of forest fires
i. How we got our national forests
j. Organization of the fire-fighters
k. What people think of the national forests
l. Reforesting in the national forests
m. Use of the national forests for recreation

USING NEW WORDS IN NEW WAYS

In the lesson about rubbish beginning on page 90 there are some words and expressions which may have been new to you. Look up each of those listed below to see how it was used in "A Fireman Talks about Rubbish," and then use it in a new sentence of your own.

accumulate
clipped lawns
excelsior
more efficient
metal containers
spontaneous combustion
dispose of furniture
a menace to your neighbors
awnings at the windows
an enemy aëroplane
unsightly rubbish piles
cotton waste
gravel paths
the garret
a plumber's torch
a source of disease

HOW TO TREAT A BRUISE

Have you ever had a bad bruise? Do you know what made the bruised spot turn black and blue?

When the skin is bruised, some of the small blood vessels beneath the skin are broken. The blood escaping from these broken blood vessels causes the black and blue spot.

Many of the bruises which boys and girls receive are so slight that no attention need be given them. But if the bruise is severe, it should be treated to keep down the swelling and to lessen the pain.

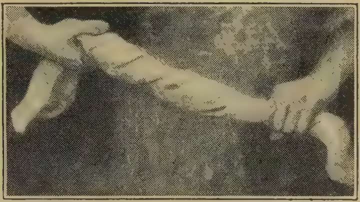
Do you know what to do for a bad bruise?

The following treatment will soon relieve the pain.

As soon as possible, apply ice or very cold water or hot water to the bruised spot. If ice is used, it may be put directly on the bruise. If hot or cold water is used, it is better to dip a cloth into the water and apply it to the bruise.

Treating a bruise in this way contracts the blood vessels and prevents more blood from escaping. It lessens the pain by deadening the nerves.

Many people find it painful to wring cloths out of hot water. Here is an easy way to do this. Fold

a cloth into a convenient size for covering the bruise. Flannel is the best kind of cloth to use because wool holds the heat better than cotton does. Dip this folded cloth into boiling water. With a fork or two spoons lift the cloth out of the boiling water and place it on a towel. Fold the towel over it and twist the ends of the towel in opposite directions as shown in the picture. This wrings some of the water out of the cloth. Now take the cloth out of the wet towel and fold it inside a dry towel. This makes what the doctor calls a hot pack. Place the hot pack on the bruise.

If the skin over the bruise is broken, paint the broken spot with iodine as you would a cut.

TEST I

Can you complete these sentences? Write the sentences on your paper.

1. A bruised spot turns black and blue because ________.

2. A bruise should be treated for two reasons:

A. ________.

B. ________.

3. To treat a bruise, apply ________.

4. The materials and utensils needed to make a hot pack are ________.

TEST II

With materials and utensils which your teacher will give you, show the class how to make a hot pack.

MAKING A LONG OUTLINE

I. You have already made some outlines. Now you are ready to make longer ones. Read this lesson about Corn, and then you may try to outline it.

Corn is the great feed crop of the nation. Four fifths of it is used where it is grown, for the feeding of cattle, sheep, and hogs. Farmers used to allow the cornstalks to go to waste. But now the whole plant — ears, stalk, and leaves — is used for feed for stock. The grain is fed either on the ear or shelled. Often the whole corn plant is chopped fine while it is still green and stored for winter use in tall tank-like bins called silos. The small part of our corn crop which is not fed to live stock is used in many different ways. All parts of the plant are utilized. Much corn is raised in our gardens for the sweet juicy kernels of which many people are so fond. Some of the grain is ground into meal to be used for bread. The kernel is also used in the making of corn sirup, cornstarch, laundry starch, hominy, and corn oil, which is one of the most valuable corn products. Mixed with finely ground leaves and husks it makes an oil cake, which is fed to chickens and cattle. The corn silk is used as filter, the husks for making mattresses, the cobs for corncob pipes, and the outer parts of the stalk for varnish. Corn has won first place among our cereals, not only because it is our largest and most valuable crop, but because of the very many purposes it serves.

What is this paragraph about? What paragraph heading may be used?

We may decide to call it *Uses of corn*, or *How corn is used*, or *How our corn crop is used.* Did you notice that the paragraph tells how each part of the corn plant is used? Find out how many parts of the corn plant are used. There are the kernel or grain, the stalk, the leaves, the corn silk, the husks, and the cobs. That makes six. That means that we shall have six parts, or subheadings, under our paragraph heading. They will be

1. How the kernels are used,
2. How the stalks are used,

and so on. Tell what all six of the subheadings will be.

Now under each one of these subheadings there will be subtopics which tell the uses of each part of the corn plant. See how many uses you can find for the kernels of corn, or the grain itself. There are eight different uses. Can you find that number?

How many uses are given for the stalk? How many for the leaves? How many for the corn silk? How many for the husks? How many for the cobs?

If we make an outline of this paragraph we shall have one paragraph heading, six subhead-

ings for the different parts of the corn plant, and subtopics under each one. It will look like this:

I. *How corn is used*
  A. How the kernel (or grain) is used
    1. As stock food
    2. For people to eat
    3. For grinding into meal to be used for bread
    4. In making corn sirup
    5. In making cornstarch
    6. In making laundry starch
    7. In making hominy
    8. In making corn oil
  B. How the stalk is used
    1. As stock food
    2. The outer parts of the stalk for varnish
  C. How the leaves are used
    1. As stock food
    2. As part of oil cake for stock and poultry food
  D. How the corn silk is used
    1. As filter
  E. How the husks are used
    1. As part of oil cake for stock and poultry food
    2. In making mattresses
  F. How the cobs are used
    1. For corncob pipes

You see that there are three steps in this outline:

I. Paragraph heading
  A. Subheading
    1. Subtopic

Answer these questions from the outline:

1. How many paragraph headings are there?

2. If there were another paragraph about how corn is raised, what would its number be in this outline?

3. How many subheadings are there?

4. If the roots of the corn plant were used in some way, what would the number of such a heading be in this outline?

5. How many subheadings have two subtopics? How are they listed, with numbers or letters?

6. How many subheadings have only one subtopic?

II. Here is a paragraph about cotton. Read it and then on your paper fill in the outline which is given under the paragraph.

The fiber of the cotton is used not only for cloth-making but also for the manufacture of hosiery, embroideries, lace, and knitted undergarments. The hulls of the cotton seed are a staple food for cattle, being about as nutritious as hay. The kernel of the seed is crushed and the oil pressed out. This is used as a substitute for lard and olive oil and for vegetable fat in making soap. After the oil is removed, the rest is ground into meal which is used as a food for dairy cows and beef cattle. Because of its nitrogen it is also used for the making of mixed fertilizers. Of our cotton crop in 1917 the seeds alone were worth $340,000,000.

I.
 A.
  1.
  2.
  3.
  4.
  5.
 B.
  1.
 C.
  1.
  2.
  3.
  4.
  5.

III. Read this third paragraph. Then make an outline for it on your paper, using all the points needed to fill in the blank outline given after the paragraph.

Though iron is the most useful of all metals, it is not the only one needed for the carrying on of modern industry. The water power which is converted into electricity by great steel dynamos is carried by copper wires to the factories where it is used. Copper wire makes possible telephones and telegraphs. In our homes are used copper boilers, kettles, lamps, and many articles of brass and bronze, which are made by mixing copper with zinc or tin. Copper is one of the necessary materials for modern warfare. It is used for shell and cartridge containers, for field telephone

lines, and for wire entanglements. In January, 1917, the allied governments ordered from the United States for war use 200,000 tons of copper — the largest single order in history.

I.

A.

1.

2.

3.

B.

1.

2.

3.

4.

5.

C.

1.

2.

3.

A GREAT FRENCHMAN

If you should be asked to vote for the American who you thought had done the most good for his country, for whom should you vote? What services to his country should you point out as a reason for your choice?

Read this lesson to find out why the people of France voted as they did. In what ways did this great Frenchman serve his country? Why did all the civilized countries of the world do honor to this great man?

1. A few years ago a French newspaper asked the people of France to vote for the Frenchman who they thought had done the most good for his country. For whom do you think most people voted? The person who received the greatest number of votes was not the great general Napoleon, as you might expect, but a famous physician and scientist, Louis Pasteur. It has been said that Pasteur saved more lives than Napoleon destroyed.

2. On the evening of December 27, 1922, the bells in the little village in France where Louis Pasteur was born rang to celebrate the one-hundredth anniversary of his birth. At the same time bells throughout all France rang to do honor to

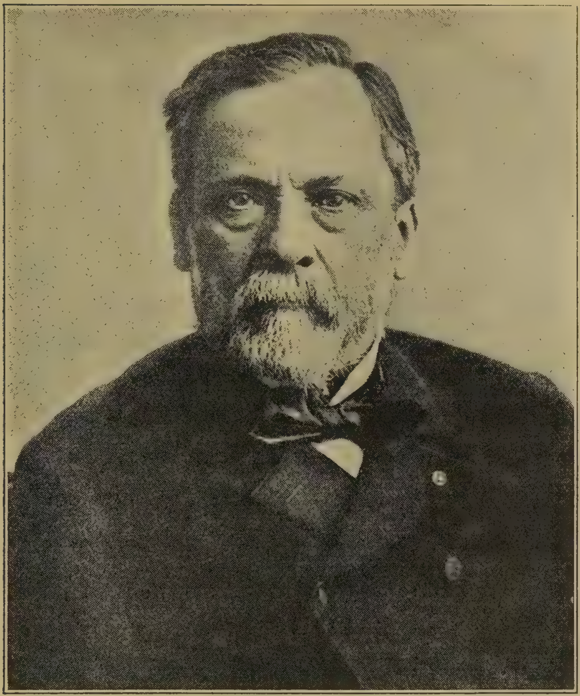
the memory of this great man. All the civilized nations of the world, also, joined France in celebrating the anniversary of Louis Pasteur's birth.

3. The boy who was later to be honored by kings and emperors was born in a humble home. His father was a tanner of leather. Louis and his father had a great love for each other, and the father, as long as he lived, understood and appreciated the work which his son did. The two often studied together in the evenings, for it was the desire of Pasteur's father that his only son should become a great scholar.

4. Sometimes he read to the boy stories of battles from the history of France, for this tanner had been a soldier in the armies of Napoleon, and had been given the cross of the Legion of Honor for his bravery. Many years afterward, when Louis had become a man, he said to his father, "In teaching me to read, your care was to teach me the greatness of France."

5. How proud Pasteur's father was, when, after many years of struggle and hard work, Louis was graduated from a great college in Paris.

6. The rest of Louis Pasteur's life was devoted to scientific work. His discoveries put an end to much ignorance and superstition.



LOUIS PASTEUR

7. At the time Pasteur lived, many people believed that if a horsehair were put into water it would turn into a snake. They believed also that caterpillars grew from leaves, and that bees came from the body of a dead bull. Other strange beliefs were that frogs and fishes grew from mud, and that mice could be produced by putting some

dirty linen into a can along with a few grains of wheat.

8. Pasteur proved that these things were not true. He showed that many plants and animals develop from eggs, or from other forms which are too small for our eyes to see without the aid of a microscope.

9. Pasteur liked to use his knowledge of science to help his countrymen. His discoveries saved the industries of France millions of dollars.

10. The first important industry which Pasteur helped was the wine industry. The makers of wine had begun to lose much money because diseases were attacking the wines, causing them to spoil. Even the best of wines sometimes went bad, and the wine-makers could not discover the cause of the trouble. The emperor of France asked Pasteur to try to find a way to keep the wines from spoiling. Pasteur found that the diseases which were attacking the wines were caused by living organisms called bacteria. After much study, he discovered that heating the wines kept them from spoiling. This was because the heat destroyed the bacteria. But the makers of wine were at first unwilling to heat their wines, because they thought that this spoiled the flavor.

In order to find out whether or not heating did spoil the flavor of wine, the following experiment was tried.

11. Some wine was placed on a ship. Half of it was heated and half was not heated. The vessel sailed for ten months and at the end of that time the wine was examined. The wine which had been heated had a fine flavor, but that which had not been heated was spoiled.

12. While Pasteur was still working on the diseases of wine, he was asked to go to southern France to study a disease which was destroying the silkworms there. The worms were dying in such numbers that the silk industry of France was in danger of being wiped out. Pasteur worked for six years before he found a way to protect the silkworms from the diseases which were attacking them.

13. A third industry to benefit from the work of Pasteur was the agricultural industry. Pasteur discovered how to vaccinate animals to protect them from certain diseases. When he said that he could save cattle and sheep from a very deadly disease called anthrax, by vaccinating them, many people laughed at him. He offered to prove the worth of his discovery by a public experiment.

14. Fifty healthy sheep were given to him for the experiment. A crowd of doctors, farmers, scientists, and newspaper men came to see the test. Many of these people expected the experiment to be a complete failure.

15. Twenty-five of the sheep were vaccinated. The other twenty-five were not vaccinated. Some days afterward the fifty sheep were given the germs which cause anthrax. A month later the crowd again gathered to learn the results of the experiment. When Pasteur arrived, they broke into a wild cheer. Twenty-two of the unvaccinated sheep were dead; the other three were dying. But all the vaccinated sheep were alive.

16. The work which Pasteur did for the industries of his country is important, but far more important is what he did to relieve the suffering and to improve the health of human beings.

17. It was Pasteur who discovered that diseases are caused by living germs. People had believed that infectious diseases were caused by evil spirits, by spots on the sun, or by vapors that rose from the earth. The importance of Pasteur's discovery has made possible much of the great life-saving work which doctors have done in the last fifty years.

18. The greatest work which Pasteur did was to discover a method of saving the lives of people who had been bitten by "mad" dogs and by other "mad" animals. The disease which results from the bite of a "mad" dog is called hydrophobia, or rabies.

19. Before Pasteur discovered a way to check rabies, men had been so afraid of this terrible disease that they ran away from those who were ill with it, leaving them to die without care. All sorts of ridiculous cures, such as crawfishes' eyes, were suggested. Another of these cures was a so-called mad-stone. This stone was supposed to cling to the wound to which it was applied, until it drew off the poison from the body, dropping off after it had done its work.

20. Pasteur discovered that the germs of rabies were found in the saliva of the infected animal. He found a way to vaccinate people who had been bitten by a "mad," or rabid, animal, so that rabies did not develop. The treatment was first used on animals and was successful, but Pasteur hesitated to use it on people.

21. While he was making more sure of his methods, a chance came to test the value of the cure. A little nine-year-old boy who had been bitten by

a "mad" dog was brought by his mother to Pasteur's laboratory. Two days before the boy, while on his way to school, had been attacked by a "mad" dog, thrown to the ground, and severely bitten about the hands and face. The case was a particularly dangerous one because it was so long since the boy had been bitten.

22. The treatment which Pasteur gave the boy extended over a number of days. Everyone waited anxiously for the result. There was great rejoicing when the boy did not develop rabies. The treatment had been successful.

23. A short time afterward another boy was brought to Pasteur for treatment. This boy was a shepherd who had been bitten while trying to protect some younger children from a "mad" dog. Although the boy had been bitten six days before the treatment was begun, he was successfully treated.

24. Across the sea in America, a group of people raised money enough to send four poor children who had been bitten by so-called "mad" dogs, to France for treatment at Pasteur's laboratory. The children arrived in Paris many days after they had been bitten, but the treatment was successful.

THE PASTEUR INSTITUTE IN PARIS

25. At one time nineteen Russians who had been bitten by rabid wolves came to Pasteur's laboratory for treatment. It was very doubtful whether these men could be saved, because two weeks had gone by since they were bitten. They were given the treatment twice a day. Only three of the men died.

26. In appreciation of what Pasteur had done for these Russians, the Czar, then the ruler of Russia, presented Pasteur with a diamond cross and a large sum of money to be used in his work.

27. Today it is no longer necessary to go to Paris to secure treatment for rabies. This treatment is given in many places in our own country as well as in foreign countries. Do you know where in your own state you could receive treatment if you were bitten by a "mad" dog?

28. Another way in which Pasteur served humanity was by the discovery of a method of heating milk to kill the dangerous germs in it. Milk which has been treated in this way is called "pasteurized" milk. By this discovery Pasteur helped to save the lives of many babies.

29. In Paris is the famous Pasteur Institute. This beautiful building was built for Pasteur while he was still alive. The money for the building was given by people from all over the world. Kings and emperors as well as poor people contributed to it. This Institute conducts experiments to help discover ways of making the world a more healthful place in which to live. It has been called "the world's greatest life-saving institution." In front of the building is a statue showing a shepherd boy wrestling with a mad dog. The man who is standing beside the statue in the picture was once the shepherd boy whom Pasteur saved. This man is now janitor of the Pasteur Institute.

30. On Pasteur's seventieth birthday a great celebration was held in Paris. Doctors, scientists, and statesmen from England, Russia, Germany, Italy, the United States, and many other countries of the world came to honor Pasteur; even the President of France was there.

31. Three years later Pasteur died. He was buried in a beautiful chapel at the base of the Pasteur Institute.

TEST

On a sheet of paper write a list of Pasteur's services to his country. In order to keep your answers as brief as possible, you may set them down like this:

Pasteur's Discoveries	Results
1. How to pasteurize milk	Saved the lives of thousands of babies

When you have listed all the services you can, draw a line under what you have written and go back through the lesson to see if you can add to your list.

When you have completed your list, put an X before each discovery which you think was important to the rest of the world as well as to France.

LEARNING TO DIVIDE MATERIAL BY MEANS OF SECTIONAL HEADINGS

Many of the books which you use contain sectional and paragraph headings. These help you to locate material rapidly. The sectional headings

which follow were copied from a geography. They divided into sections the material given about the subject "Brazil."

Extent	Resources
Rivers	Climate
People	Occupations

The story "A Great Frenchman" might be divided into sections by the following sectional headings:

Introduction: The man who best served France
Pasteur's boyhood and education
Discoveries which lessened ignorance and superstition
Pasteur's services to the industries of France
Pasteur's services to humanity
The Pasteur Institute
Celebration of Pasteur's seventieth birthday
Conclusion

Can you decide which paragraphs would be included under each heading? Copy these headings on a sheet of paper, leaving a blank line after each heading. On the blank line below each heading write the numbers of the paragraphs which you think belong under that heading. For the first sectional heading you would write:

The man who best served France
1, 2.

LEARNING TO DIVIDE MATERIAL BY MEANS OF MARGINAL HEADINGS

In some books the material included under each sectional heading is further divided into sections by means of headings which are printed in the margin at the side of the page. These are called marginal headings. Many geographies have marginal headings. Does yours? Below are the marginal headings which, in one geography, divided the sectional heading *The dependence of the West upon irrigation* into still smaller sections.

How a study of the land regions showed the need for irrigation
How irrigation projects are planned
Extent of irrigation in the West

The sections into which you divided the story "A Great Frenchman" might be further divided by marginal headings.

Two plans for marginal headings to be used under the sectional heading *Pasteur's services to the industries of France* follow.

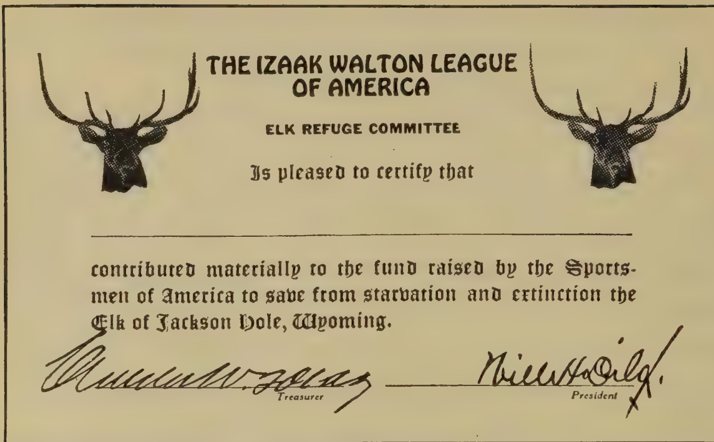
1. Pasteur's services to the industries of France
   a. To the wine industry
   b. To the silk industry
   c. To the agricultural industry

2. Pasteur's services to the industries of France
    Pasteur discovers a way to prevent anthrax
    Pasteur saves the silk industry
    Pasteur discovers a way to keep wines from spoiling

Which of these plans do you like the better? Copy on a sheet of paper the headings as given in the plan you like the better, leaving a blank line after each of the marginal headings. On the blank line below each of these headings, write the numbers of the paragraphs which should be included under that marginal heading.

MAKING MARGINAL HEADINGS

With what marginal headings could you divide the section *Pasteur's services to humanity*? Write your marginal headings on your paper, using every other line. On the blank line under each marginal heading write the numbers of the paragraphs which this marginal heading should include.


THE IZAAK WALTON LEAGUE OF AMERICA

ELK REFUGE COMMITTEE

Is pleased to certify that

contributed materially to the fund raised by the Sportsmen of America to save from starvation and extinction the Elk of Jackson Hole, Wyoming.

Treasurer

President

HOW TO READ A GRAPH

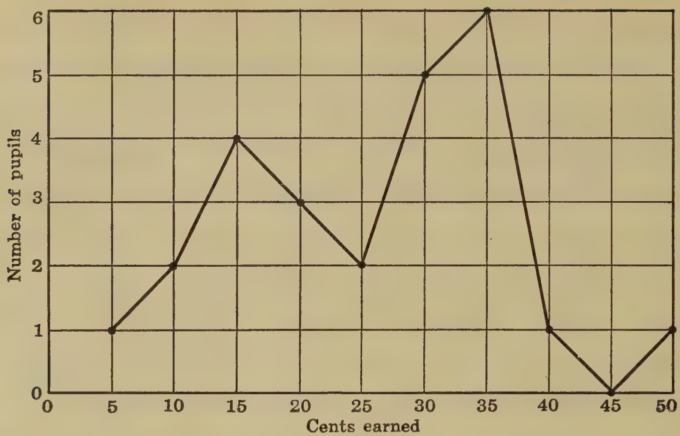
Many of you have belonged to Audubon clubs, through which you learned about the different kinds of birds and how to protect them. There are other organizations besides the Audubon Society which try to protect birds and animals. The Izaak Walton League of America is one of these organizations. It has for its purpose the protection of the wild life of our country.

Through the efforts of the Izaak Walton League, many elk at Jackson Hole, Wyoming, were saved. At one time there were about fifty thousand elk in the Jackson Hole region, but lack of food had

reduced the herd until only a few hundred were left. Much of the land on which the elk formerly pastured had been turned into farms, and there was not enough left to provide pasturage for summer feeding and a supply of hay for winter when the ground was deeply covered with snow. Every winter many elk starved to death. The Izaak Walton League asked the people of our country to raise one hundred thousand dollars to buy additional Jackson Hole hay lands.

The certificate at the top of page 182 is one which the boys and girls of a sixth grade received from the Izaak Walton League for helping to save the elk at Jackson Hole, Wyoming. The boys and girls earned the money to help the League in this undertaking. As each one brought his money he told the class how he had earned it. These are some of the ways which were reported:

Running errands
Raking the yard
Washing and wiping dishes
Dusting the furniture
Ironing clothes
Taking care of small children
Setting the table
Hoeing the garden
Mowing the lawn



The graph at the top of the page tells how much money the sixth grade succeeded in earning.

The graph shows two things: the numbers along the bottom of the graph show the different amounts of money earned; the numbers along the left-hand margin of the graph show how many pupils earned each amount.

Find the first dot at the left-hand side of the graph. It is opposite number 1 and above number 5. This dot shows that one child earned five cents.

Find the second dot. It is opposite number 2 and above number 10. This dot shows that two children earned ten cents each.

How many children earned fifteen cents each?

How many children earned twenty cents each?

How many children earned twenty-five cents each?

What amount each did five pupils earn?

Which amount of money was earned by the most pupils? How many pupils earned this amount?

How many children earned forty cents each?

What amount of money did no pupil earn?

What was the largest amount earned? How many pupils earned this amount?

Now read the whole graph in this way: For the Izaak Walton League one pupil earned five cents, two pupils earned ten cents, and so on.

A TEST OF HOW WELL YOU UNDERSTAND THIS GRAPH

1. Can you find out how much money the whole class earned to send to the Izaak Walton League? Put it down in this way:

One pupil earned 5 cents	.05
Two pupils earned 10 cents	.20

What was the total amount?

2. Has your grade ever earned any money? Perhaps you have earned money for the Red

Cross, to buy magazines for your school, or to provide toys for crippled children. Make a graph somewhat like the one in this lesson to show the amounts earned.

If you have not earned any money, make a graph to show how many words were missed by your class in spelling and the number of words missed by each pupil.

PRACTICE IN REMEMBERING

Some time ago you learned the rules to remember in order to care for a cut. We are not likely to remember things a long while unless we practice remembering them.

How many of the rules for the care of a cut can you say now? Say as many of the rules as you can. If you have forgotten any of them, turn back to the lesson on page 61 and study those which you have left out.

WHAT IS A GOOD SUMMARY?

Have you ever heard anyone speak of putting ideas in a nutshell? Do you know what that means?

Sometimes people want to tell their ideas in the fewest words possible. They want their ideas to be clear. This is what they accomplish by putting their ideas in a nutshell. We call it making a summary.

In making talks in class, in summing up points for review, or in making clear recitations, you often need to make a good summary. What is a good summary?

A good summary does three things: it makes the principal idea clear, it tells all the important points, and it wastes no words.

For the paragraph below three summary sentences are given. Read the paragraph to see why one of these summaries is better than the others.

People who go on holidays often feel such freedom that they take reckless chances. They gather together a few sticks, boil their coffee or fry their fish over the blaze, and then forget about the fire. It will go out, they think, when perhaps it may smolder for hours until a gust of wind fans it again into flame and it begins to spread over the country. Forest fires are caused in this way.

Now read the summary sentences.

1. Picnickers often cause forest fires.

2. Picnickers build fires with sticks to boil their coffee and fry their fish and then go off and leave their fires to smolder into a blaze.

3. Picnickers cause forest fires by leaving smoldering fires which the wind fans into flames.

The first summary is not good. It tells the principal idea but is so short that it leaves out important facts.

Read the second again. This is not a good summary because it tells too much. It tells unimportant facts. Which facts do you think are not important in this summary?

Read the third summary. This is the best one because it gives the principal idea, it tells all the points necessary, and yet it does not have unnecessary words.

For the following paragraph three summaries will be given. Read the paragraph carefully so that you can select the best summary sentence.

Many people believe that small fires among the leaves or underbrush are harmless; that, in fact, it is good thus to "clear" the woods. Yet such fires are very harmful. They wound the larger trees and destroy the young growth and seedlings from which the next forest must come. Also, they

rob the forest of nature's "sponge" for holding moisture, and her fertilizer for feeding the trees, by burning up the humus. No forest fire is harmless, no matter how small. Then, too, there is always danger of its getting beyond control.

Summary sentences

1. Many people think small fires are good because they clear the woods; but they are harmful because they wound the larger trees and destroy the young growth and seedlings from which the next forest must come.
2. Small fires are harmful because they wound the larger trees, destroy the young growth and seedlings, rob the forest of its moisture and fertilizer for the trees, and may get beyond control.
3. Even small forest fires are harmful.

Which is the best summary sentence? Why?
Why is neither of the other two so good?
What three things does a good summary do?

THE STORY OF HOW MAN HAS LEFT RECORDS

PART I. EARLY FORMS OF COMMUNICATION

It is hard to realize that books, which we use so commonly and can buy so cheaply, have taken thousands of years to be developed into their present form. Of course, long ages ago when men still hunted and fished for their food, and made their clothing from the skins of wild animals, there were no books, no paper, and no alphabet with which to make words. Pictures scratched or carved on rocks, bones, or pieces of ivory from some animal's tusk were made to tell the story of important happenings; and notches cut along the edges of bones or sticks helped the people of those days to count.

When messages were sent to people who spoke other languages, the messengers carried not carefully written letters, but objects which had special meanings. The Indians in this country were keeping their records and sending their messages in these ways when the first white men came. Many savage tribes are doing it today. We are all familiar with the story of how an unfriendly tribe

CAN YOU TELL WHAT EACH ROCK CARVING MEANS?

of Indians sent to Miles Standish, Captain of Plymouth, a bunch of arrows tied with a snake-skin. Miles Standish understood that this meant the Indians were about to attack the colony. He therefore frightened them by sending back a snake-skin filled with powder and bullets, of which they were very much afraid.

Of course, a long message sometimes became hard to carry if many objects were necessary to tell it, and so it is natural that pictures came to

THE BATTLE RECORD OF AN INDIAN CHIEF

take the place of objects. A hunter could easily send home a message in pictures telling that he had traveled across a large lake in his canoe, through high mountains on foot, and had at last been successful in killing a number of deer.

The drawing, a copy of which is given above, describes the victory of Wingemund, the chief

of the Leni Lenape tribe, who attacked the English settlements in the years 1762 and 1763. The lines at the bottom of the picture show the twenty-three warriors, bending forward as they proceed on the warpath. The horizontal lines at the right indicate that the sun has made ten pathways, four days of which made up one expedition and six days the other. In the center of the picture are the three English forts which were attacked: Fort Pitt at the joining of the Allegheny and Monongahela rivers, the square fort of the Detroit trading station, and the small fort on an island in Lake Erie. The ten conquered enemies are seen at the left. The four with heads are prisoners, the other six represent the slain. The tortoise in the corner is a symbol which was commonly used by the Indians to represent safety.

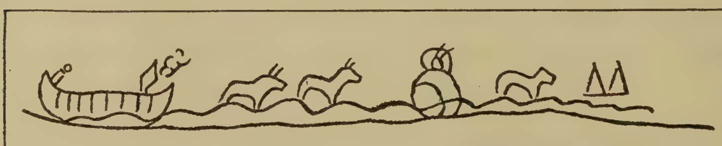
Many such pictures have been found, buried deep down in the ground, or hidden away on the walls of old caves. Some of them are only pictures of what the artist saw; some clearly mean to tell a story or record some important event. These old records are interesting to us not only because they tell us much about the way people lived in those far-off days, but because they show us the first steps in the art of writing.

EXERCISES

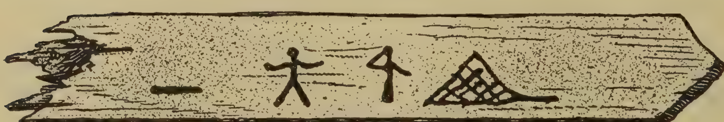
1. This section tells about early methods of communication. Each paragraph helps. Try to make a summary sentence for each paragraph, showing these early methods of making records.

2. Each of the picture records below has a message. Can you read their meaning?

3. With pictures write some picture sentences of your own. See if the members of your class can read them.



HUNTING RECORD OF AN OJIBWAY INDIAN



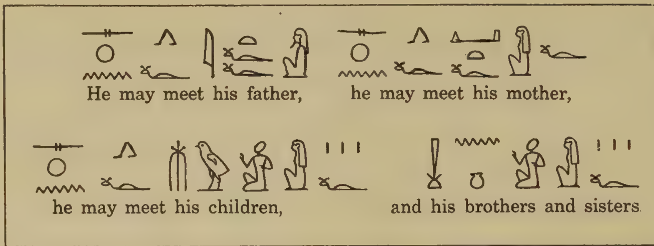
MESSAGE LEFT ON A PIECE OF WOOD BY A STARVING HUNTER

THE STORY OF HOW MAN HAS LEFT RECORDS

PART II. HOW WE GOT OUR ALPHABET

Nowadays when we are learning to do something, we sometimes say we haven't learned the A B C's of it yet, meaning that we don't yet know even the first things about it. Or if we want to say that something is easy to do or to learn, we say it is as easy as the A B C's. But really the A B C's are not the beginning of writing, as we have just seen in the study of picture-writing; and the alphabet was not easy to get, but has taken thousands of years to grow into its present form.

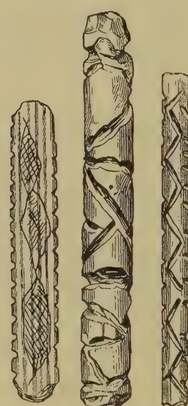
Our alphabet, as well as the alphabet of every other language, had its beginning in pictures of objects. These pictures, more or less changed, came to stand as words. We still use some of these old picture-words. It is thought that Roman numerals came from pictures of the fingers and hand. I, II, III, were probably pictures of fingers; and V was a picture of the fork of the hand with the fingers together and the thumb apart, thus meaning the whole hand, or five.



An Egyptian Papyrus Transcription

Eskimo Drawings on Bow Drills

A Painting from a Rock Shelter in Spain



Australian Message Sticks

Some of our common trade-signs come from these old picture-words. The bent arm holding a hammer is an old sign of the workman who makes gold articles. The barber's white pole with its red spiral is the old sign of the barber surgeon who bound up the arm of his patient with a red bandage. The pointing hand is always understood to mean either "Look there" or "This way."

But sometimes one word had two or more different meanings. Then one picture stood for all the meanings. For instance, in Egypt there was a little black beetle whose name was the same as the word for "to become," so a picture of the beetle was used for "beetle" and for "to become." It was as though in our language we made a picture of the sun stand for both *sun* and *son*.

After a long time the picture came to stand not for the whole word but for some sound in the word. To see how this worked, let us follow the history of our letter *m*. In the old Egyptian language the name of the owl was *mulak*. The picture of the owl stood for the word itself. Then the picture came to stand for only the sound *m*. But while this change was happening, the picture of the owl changed and was shortened until we

THIS SHOWS THE DEVELOPMENT OF OUR LETTER "M" FROM THE EGYPTIAN PICTURE-WORD FOR THE OWL. THE LAST FOUR SQUARES SHOW THE CHANGES MADE BY THE EGYPTIANS, PHŒNICIANS, GREEKS, AND ROMANS

have our letter M, which really is only the two ears of the owl. Almost every letter can be traced back in the same way to the time when it was a whole picture standing for a word.

EXERCISES

Answer these questions in complete statements and you will have a summary paragraph telling how we got our alphabet.

1. Did one group of people make our alphabet?
2. How long has it taken for it to be developed?
3. With what did our alphabet begin?
4. For what did these pictures stand?
5. For what did these pictures stand later on?
6. Were the pictures changed, too? Into what?
7. To what can these parts of pictures which stand for letters be traced?

THE STORY OF HOW MAN HAS LEFT RECORDS

PART III. FROM STONE TO PAPER

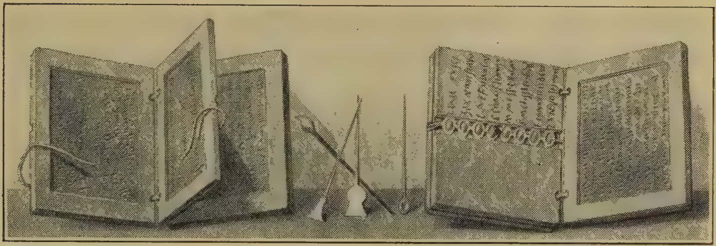
While all these changes in the kinds of writing were going on, there were many changes in the kinds of things people were writing on, too. We have seen that the earliest records were made on stone, wood, and ivory. Sheets of bronze and lead were often used on which to carve public records. The laws were sometimes carved on metal or stone tablets of this kind. In Babylonia soft clay tablets or bricks were written upon and then baked in the sun or in fire. These lasted many years. In the ruins of one old city more than thirty-two thousand clay tablets were found. Some are military records, others are hymns to the gods, notes on geography, poems, fables, proverbs, lists of stones, trees, birds, and beasts, letters, and many other things of interest. The Romans used sheets of soft metal and small wax writing-tablets. These tablets were of wood, one side being slightly hollowed out to hold the wax coating. Usually two of these were hinged together, but sometimes there were three or more

fastened with rings or leather strings. These were the very first records that were written in real book form.

People wrote on these wax tablets with instruments called styles. These styles were pointed at one end for writing, and were flat at the other end for erasing. They were made of iron, bronze, brass, wood, bone, ivory, or even gold and silver. Some of the styles were very beautifully carved and decorated.

All these things seem very different and a long way from the paper on which we write to-day with pen and ink and pencil. But even at the time some people were using the clay and metal and wax tablets, the Egyptians were making a kind of paper from the inner bark of a reed that was called

A BABYLONIAN CLAY TABLET



ROMAN WAX TABLETS AND STYLES

papyrus which grew along the banks of the Nile. Strips of this bark were laid over one another crosswise, fixed together with mud or gum, and dried. The Egyptians wrote on the papyrus with a small reed-brush, using ink made of minerals, blood, the juice of berries, or charcoal. Later they used quill pens made by cutting and shaping and slitting goose quills. The long sheets of papyrus were wound around a short stick much as we wrap maps. It is from the word "papyrus" that we get our word "paper."

The Chinese used the bark of the bamboo to write upon until in about 600 A.D. they discovered how to make paper from rags. This was kept a secret for a long time, but finally the Arabs discovered how it was done and paper-making was known in Europe several hundred years before Columbus discovered America. Nowadays most

of our paper is made from wood pulp, and only the finest papers are made from rags.

EXERCISES

A. Prepare to give a good explanation of the following topics:

1. Earliest implements for writing
2. Papyrus records
3. How we learned to make paper

B. Answer from memory as rapidly as possible:

1. Were messages first sent by means of pictures?
2. Were picture messages usually traced with charcoal?
3. Did American Indians keep picture records?
4. Did a picture in an Indian message have a certain definite meaning which remained the same?
5. Are picture messages ever used nowadays?
6. Did our alphabet begin with pictures of objects?
7. Did the Chinese have something to do with our alphabet?
8. Do the letters in our alphabet now stand for words?

THE STORY OF HOW MAN HAS LEFT RECORDS

PART IV. DEVELOPMENT OF PRINTING

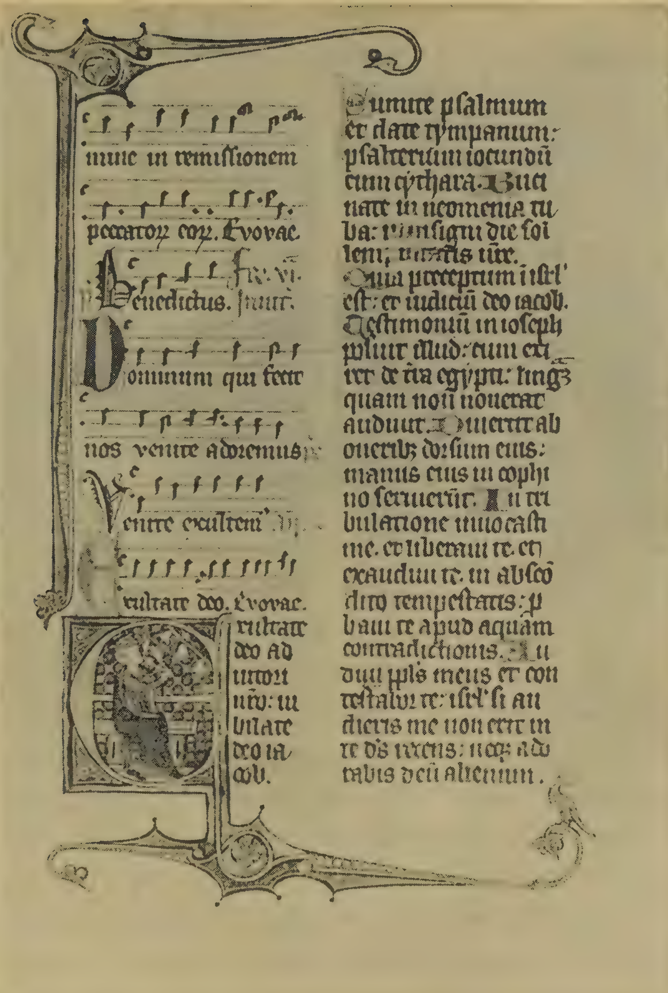
But even with these great improvements in the materials on which people might write, most of the writing on the papyrus manuscripts and even on the new kinds of paper was done by hand. Many of the books of that time were church books; some were about travel; some were about the study of the stars, in which people were very much interested. Only a few people knew how to write in those days, and books were something to be highly prized. Since the monks who lived in the monasteries were the best-educated people of the time, it is easy to see why most of the old books and manuscripts were made by them. Their books which have been kept till today are very beautiful, with great initial letters in the most brilliant colors. Sometimes slaves had to do the writing. A group of slaves copied in their fine neat handwriting what someone read to them from another manuscript.

But although most of the books were done by hand, there were some beginnings in using type.

Sometimes the initial letters were printed with a wooden stamp on which a very beautiful capital letter had been carved. In some countries these letter or design stamps were made of baked clay. Such letter stamps could be used over and over, just as a rubber stamp can be, by inking the letters.

A further development of a sort of type was the carving of solid blocks of wood with which to print whole pages. These blocks often had many pictures on them, but the pictures and letters were both carved on the face of a solid wooden block. This block was then inked, and damp paper laid on it to take off the impression. This was called block printing. Many religious books were printed in this way, but it was a very slow process. It took a long time to carve each print block, and when it was done it could never print anything but that one page.

It was plain to be seen that printing could never be done very fast until a system were found by which the carved type could be used again and again. If each letter were a separate piece which could be put in or taken out as the printer pleased, the printing could be done very much faster. There have been many disputes over who



mine in remissionem
peccatoR. Evovae.
Benedictus. Invit.
Dominum qui fecit
nos venite adoremus
Venite exultem
Exultate deo. Evovae.
Exultate
deo ad
iutori
nro: iu
bilate
deo ia
cob.

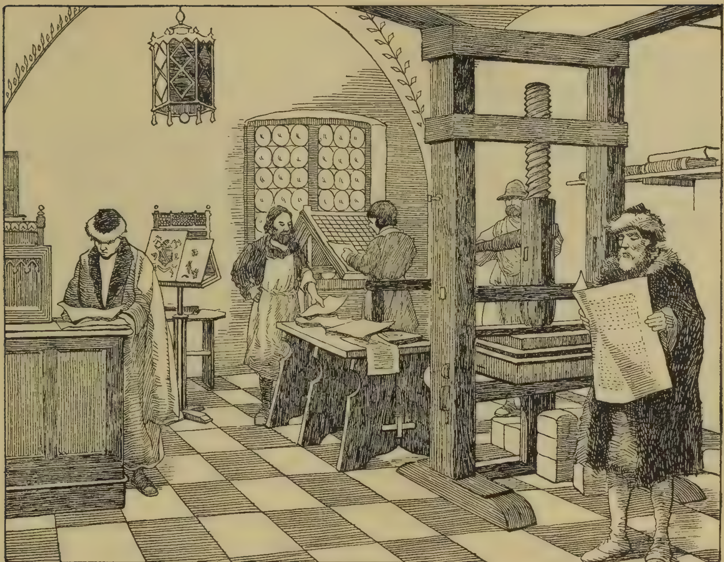
Sumite psalmum
et date tympanum:
psalterium iocundū
cum cythara. Bucci
nate in neomenia tu
ba: in insigni die sol
lem; vestris.
Quia preceptum i isrl'
est: et iudiciū deo iacob.
Testimoniū in ioseph
posuit illud: cum exi
ret de tra egypti: lingᵃ
quam non noverat
audivit. Divertit ab
oneribꝫ dorsum eius:
manus eius in cophi
no servierūt. In tri
bulatione invocasti
me. et liberavi te. ex
audivi te. in abscō
dito tempestatis: p
bavi te apud aquam
contradictionis. Au
di ppls meus et con
testabor te: isrl' si au
dieris me non erit in
te ds recens: neqꝫ ado
rabis deū alienum.

A LEAF FROM A FOURTEENTH-CENTURY SERVICE BOOK,
BEAUTIFULLY LETTERED AND DECORATED BY HAND

WOODCUTS ARE STILL USED FOR ILLUSTRATIONS. THIS IS A MODERN WOODCUT. HOW IS IT DIFFERENT FROM OTHER ILLUSTRATIONS?

was the real inventor of printing with movable type, but most people now believe that the honor belongs to Johann Gutenberg. He made type of uniform size so that it could be locked together for printing without being uneven or falling apart; the type was also of uniform height so that all type letters would print; and it was of material which was so cheap and easy to work with that he could have enough types of each letter for printing his material. These three things really were the invention of printing.

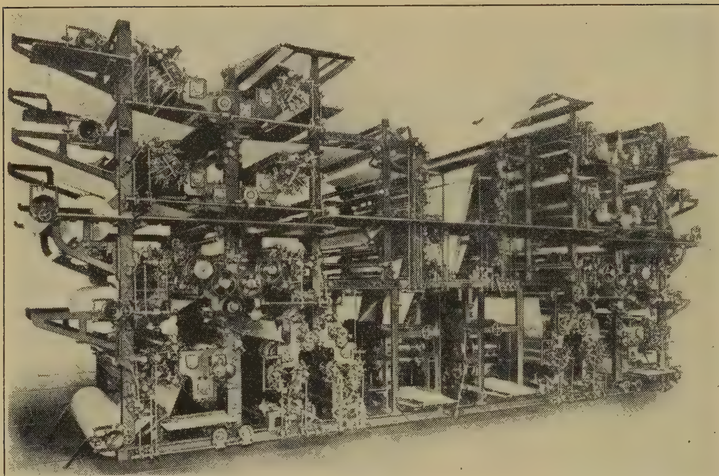
With this movable type a page was set up; that



GUTENBERG'S PRINTING PRESS

is, the letters were placed in order in a frame, the letter end of the type up, like a rubber stamp. When the whole page was set up, it was "locked up" so that it would not fall apart. Then the type was inked, and the impression was taken off by placing the paper on the inked type and pressing it down firmly with a heavy hand-press.

Later inventions in printing machinery have resulted in wonderful progress. When each individual letter had to be set in place by hand, it



A MODERN PRINTING PRESS

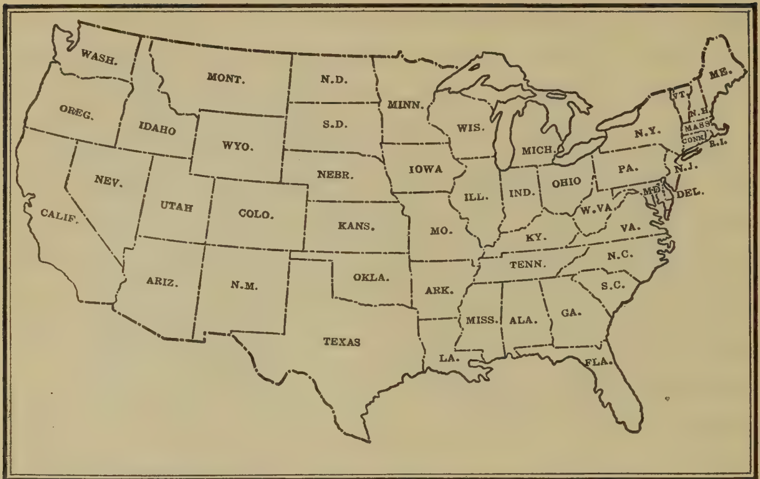
took a very long time to set up a whole book. But the invention of the linotype and monotype made possible much more rapid work. The operator of a linotype sits at a keyboard which is somewhat like a typewriter. By pressing the keys of the keyboard, he makes the type out of melted metal which is in the machine and sets up a line of the type in position ready to print. The machine is called a linotype because it makes and sets up a line of type. The monotype is somewhat the same, but it sets up one letter separately instead of the whole line. If a mistake is made in the

line, it is much easier to correct it by replacing the one or two wrong letters than by re-making the whole line as must be done with the linotype.

Improvements in presses, the means of taking off the impression of the type on paper, have been made, too. The old hand-press, run by two men, could print in an hour one hundred sheets eighteen by thirty inches in size, on one side only. A modern power press prints, folds, and pastes thirty-six thousand twenty-four page newspapers in an hour.

EXERCISE

This section is called "Development of Printing." It might also be named "From Hand-made Books to Press-made Books." Keeping in mind this development, jot down a list of things which you should refer to in giving a summary discussion of this section. You will have about six *main* points.



HOW TO SHOW ANSWERS ON A MAP

Sketch or trace quickly a small outline map of the United States like the one given above. Do not try to put in the states on your map.

In this exercise you will need to look back at the lesson on page 57 to give you some help in answering certain questions. Now, on your outline map, do the following things:

1. Put (1) in the section on your map where a great amount of lumber was first cut.

2. From (1) draw an arrow pointing the direction in which the lumber industry next moved.

3. Put (2) in the section which was the center of the lumber industry in 1880.

4. Put (3) in the section which next led in lumber production.

5. Put (4) in the section which now leads in the lumber industry.

6. Under these numbers on your map print the names of the trees which were the chief kinds cut in each region.

7. Put (5) in the region in which forests were cut, but not chiefly for lumber.

8. Under (5) print the names of the trees which were found in this region.

(Chicago is in Illinois on the shore of Lake Michigan. Bangor, Maine, is in about the middle of the state east and west, on Penobscot Bay, the biggest bay on the Maine coast.)

9. Put (6) for the city which was the first center of the lumber trade.

10. Put (7) for the city which was the center of the lumber trade in 1880.

MAKING THE ATMOSPHERE WORK[1]

You probably know that air can be made to work for man by turning windmills. Did you know that air can be made to do a great many other kinds of useful work for man? Read this lesson to see how man makes the air work for him.

Is a tumbler ever empty?

We usually speak of a tumbler as empty when we can see nothing in it. It is perfectly natural to say this, but if it were strictly true, there are some things that it would be impossible to explain. If you try to press a tumbler, mouth downward, into a vessel of water, you find it hard to do so. It feels as if there were something already in the tumbler, something resisting the entrance of the water. The tumbler could not have been empty. There was something in it and that something was air.

If you tip a tumbler a little to one side as you press it down into the water, it will be easier to fill it with water. That is because you have given the air a chance to escape, or rather to be pressed out by the incoming water. It is very easy indeed to fill the tumbler by pouring the water from a

[1] Nichols, Science for Boys and Girls (Adapted).

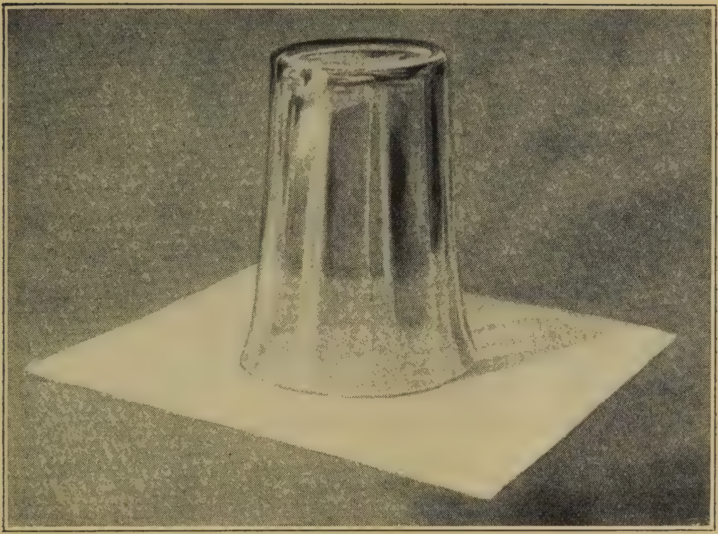


FIG. 1

pitcher because then the weight of the water pushes the air out at the top of the tumbler.

After having filled the tumbler in this way, press a piece of cardboard firmly over its mouth and carefully turn both upside down, as is shown in the picture at the top of the page. You will, of course, expect the cardboard to fall off and the water to come tumbling after. Nothing of the kind, however, will happen, if you have performed the experiment with care. The cardboard will keep its position and the water will remain in

the glass. This will astonish you, and it is indeed hard to explain unless we realize that all about us there is a substance, air, and that this substance exerts pressure upwards as well as downwards. This is because it has weight, a fact which can be easily proved by weighing a football or an air pillow both before and after it has been blown up with air. The weight of the air pressing against the cardboard is greater than the weight of the water in the tumbler. The pressure of the air keeps the cardboard in position.

You can get a very good idea of how great the pressure of the atmosphere is by boiling a small quantity of water in an open tin can and, after fastening the cover on tightly, allowing it to cool. A good kind of can to use is one with a small opening such as a sirup can like that shown in Fig. 2. After the water in the can has boiled, remove the can from the fire and quickly fasten the cover on tightly. Allow the can to cool. You will be surprised at what happens. The heat changes the water to vapor and some of it escapes into the air. On cooling, the rest of the vapor condenses to a liquid and therefore occupies less space than before. Consequently there is less pressure inside the can than outside. The difference

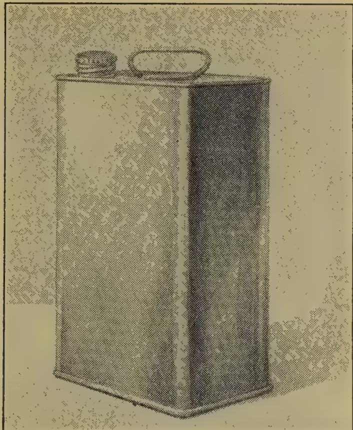


FIG. 2

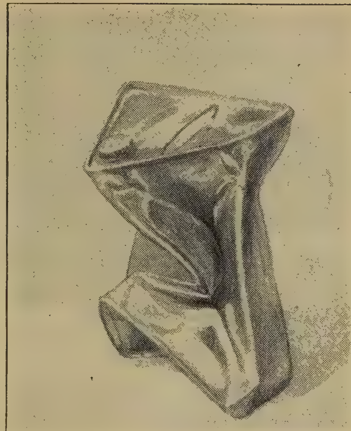


FIG. 3

in pressure causes the can to cave in. Fig. 3 shows how the can looks after the vapor has cooled.

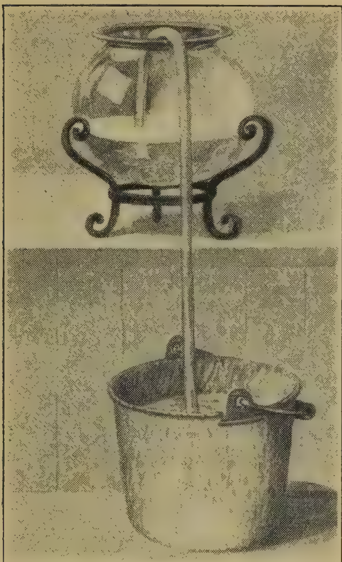
The air is a substance that can readily be moved. We feel it moving when we fan ourselves or when the wind blows. During a storm we realize how powerful air in motion can be, for we sometimes see it lifting roofs from houses, breaking limbs from trees, and tearing trees up by the roots.

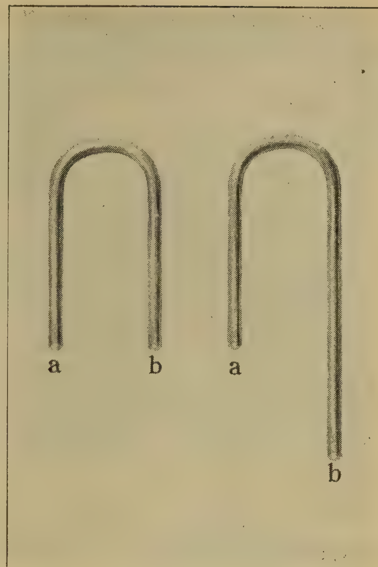
Air can be drawn or squeezed out of a vessel containing it. For instance, when you suck at the end of a straw or a glass tube, you suck out some of the air. If the other end of the tube is

open, of course air presses in to take the place of the air you have removed. Suppose, however, that you have placed the other end of the straw in a glass of lemonade. The lemonade rises to take the place of the withdrawn air.

Although it may not seem so at first, the pressure of the air is responsible for the liquid's rising in the straw. We are really living at the bottom of an ocean of air, and in spite of the fact that it seems so light a substance, the weight of the air exerts a pressure of about fifteen pounds to every square inch of surface. Since, therefore, there is a pressure of fifteen pounds on every square inch of lemonade in the glass, it is not at all surprising that the lemonade is pushed up as soon as the air is sucked out of the straw. Drawing the air out of the straw is of course the same as removing the pressure from that part of the liquid in which the straw is placed. It makes a space free from air. Such a space is called a vacuum.

In the case of the straw, you have made the air work for you. It has pushed the lemonade up to your mouth, but of course not until you have already done some work in sucking the air from the straw. Those who own a large fish bowl or





an aquarium may know of another way in which air will do work. A large, heavy aquarium is difficult to empty of its water when it becomes necessary to clean it. A quick way to empty it with little trouble is to fill a piece of rubber hose with water. Hold both ends firmly. Place the upper end of the hose beneath the surface of the water in the aquarium and allow the lower end to hang over a bucket on the floor. The water in the tube naturally falls into the bucket and its place is taken by the water in the aquarium.

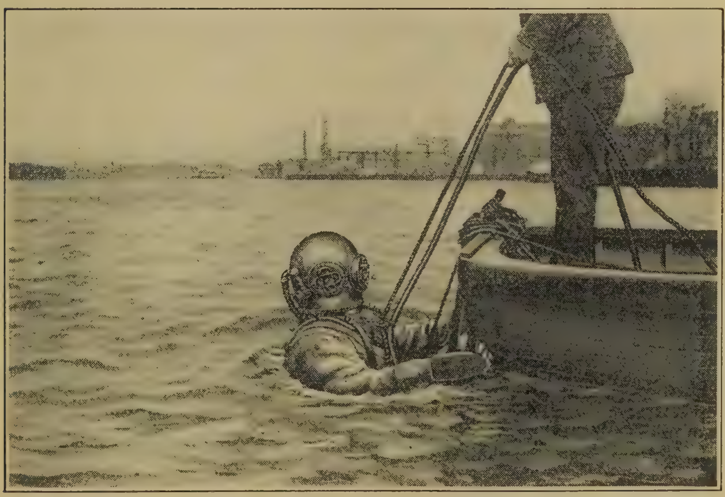
The reason for this is the same as in the case of the lemonade. It is really the pressure of the air on the surface of the water in the aquarium that is doing the work.

An arrangement of this kind is called a siphon. You will notice that in a siphon there are two arms, one of which is longer than the other. If the two arms are of equal length, the siphon will not work, because then the pressure of the air at *a* would be exactly the same as at *b*.

Siphons are useful in emptying liquids from vessels in which dirt or other substances have settled to the bottom. The liquid is drawn off so gradually that the settling is not disturbed. For this reason, siphons are used in purifying liquids and in the plumbing in your home.

We have seen that it is possible to draw air out of a tube by sucking. The opposite action of forcing more air into a space already filled with it is just as possible. This is what happens when the tire of a bicycle or an automobile is pumped up. The space inside the tire can be so well filled with air that the tire will feel firm and hard to the touch. The tire is filled with compressed air.

Nowadays, compressed air is very commonly used because of its convenience. By its use



HOW IS COMPRESSED AIR MADE TO WORK FOR THE DIVER?

letters and packages are sent from one building to another, trees are sprayed with a solution for the destruction of insects, and paint is applied to the surface of a building. Glass, also, may be cut by sand driven against it by a blast of air. The apparatus used for this purpose is known as an air gun. In mines and quarries a similar apparatus is employed to drill the holes where the explosive is placed for blasting.

No doubt you have seen doors that closed automatically by the pressure of air compressed in a cylinder close to the hinges. Air brakes on trains also work by compressed air and are a very decided improvement on the old-fashioned brakes which gave the brakemen so much work to do.

Another interesting and important use of compressed air is in work done under water by divers who are saving materials from wrecks, and by men who are laying foundations of piers or bridges. Sometimes the diver carries a tank on his back, and sometimes the air is forced into a bell or chamber below the water from a tank on the surface.

SOME EXPERIMENTS FOR YOU TO DO

The lesson you have just read tells many facts about how the atmosphere works for men.

One good way to find out whether or not you understand how the atmosphere works for man is to perform experiments to show how it works.

For a science lesson, choose one of the four statements on the next page and prove that it is true by means of an experiment. Read very carefully the part of the lesson which tells about the experiment you choose in order that your experiment may be a success. You will need to find out, first, all the materials necessary for the experiment; second, how to perform the experiment step by step. You will need to plan an explanation of the experiment to make to the class. This explanation should include the following points:

1. *The purpose of the experiment*

   Tell clearly what you are trying to prove by means of the experiment.

2. *An explanation of the materials and of the method used*

   This step is not always necessary, but the class will not understand many experiments unless you explain as you go.

3. *The conclusion*

Tell clearly what the experiment proved.

When you perform the experiment you should have on hand all the materials which are necessary, and you should follow the directions for performing the experiment carefully. Be sure to follow the directions exactly or you may fail to prove anything.

1. Air has weight.
2. Air exerts pressure.
3. Air moves.
4. Air can be compressed.

Perhaps you know other ways than those described in this lesson, in which the atmosphere works for man. The class would be interested in any other experiments you might perform to show that the weight of the air exerts pressure.

QUESTIONS AND A PROBLEM

Do you understand how the atmosphere works for man? If you read the lesson carefully and followed the experiments closely, you should be able to answer the following questions without looking back at the lesson.

1. Why is it easy to fill a tumbler by pouring water from a pitcher?

2. In the experiment in which the tin can was crushed by the pressure of the atmosphere, why was there less pressure inside the can after it cooled than while it was hot?

3. What makes a windmill go round?

4. What makes a sail boat move over the water?

5. How is it possible to suck lemonade through a straw?

6. What is a vacuum?

7. Explain how a medicine dropper is filled with liquid.

8. How would you empty a vessel of water if it were too heavy to lift from a high place?

9. Why must one arm of a siphon be longer than the other?

10. Can you name some examples of the siphon in your home?

11. Why are siphons useful in purifying liquids?

The problem

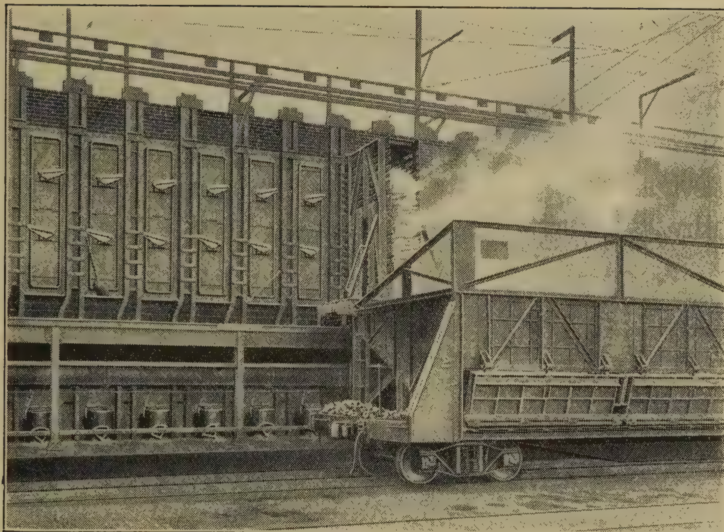
If the pressure of the atmosphere is nearly fifteen pounds to the square inch, why do we not feel its weight?

COAL-TAR WONDERS

Suppose someone should ask you to name one material from which we get dainty perfumes and deadly explosives, fountain pens and flavoring extracts, phonograph records and paving materials. Could you do it? This same material probably perfumes the soap with which you wash your hands. From it are made the moth balls with which your mother sometimes packs away your winter clothing. Even the ink with which you write may be made from it. This useful material is obtained from something which almost everyone has seen. It is made from coal. It is called coal tar.

Coal tar is a black, sticky substance. It is obtained as a by-product when coal is made into coke and into illuminating gas.

You know that when coal burns in a stove or in a furnace only ashes are left. That is because the oxygen in the air has burned up the useful part of the coal. But coal is not burned up if it is heated red hot in a closed oven where the oxygen in the air cannot get to it. When the coal is heated in this closed oven, gases are driven off by the heat. These gases may be removed through outlet pipes, and then nothing is left but a black solid material



BY-PRODUCT OVENS

called coke. Coke is used for fuel in iron furnaces because it is hard and will not choke the fire.

The gases given off as the coal changes into coke are almost as valuable as the coke itself. From these gases are obtained ammonia, illuminating gas, and coal tar. The oven which collects and saves the gas, the coal tar, and the ammonia in the making of coke is called a "by-product" oven. The picture on this page shows a row of by-product ovens.

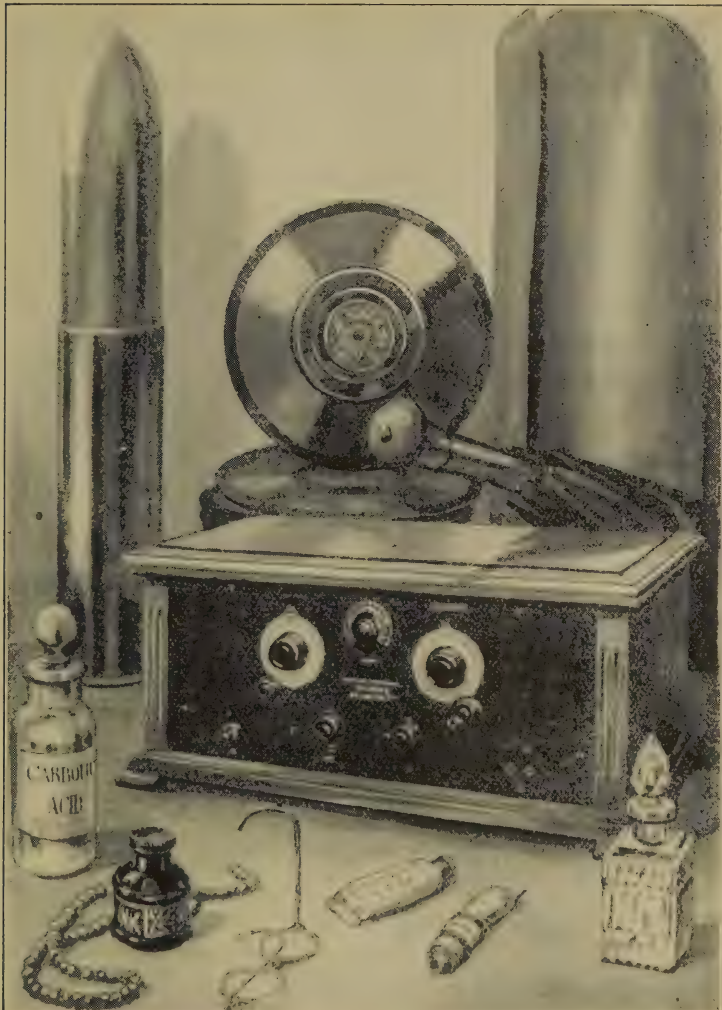
Coal tar was long regarded as a nuisance by the

makers of coke and of gas. The oily, smelly mass clogged up the pipes, so the gas-makers and coke-makers washed it out and got rid of it as best they could. Some of it was sold for roofing; most of it was wasted.

But this evil-smelling "nuisance" has been found to be one of the most useful raw materials in the world. From it the chemist seems able to make almost anything he wishes, from medicines to explosives, from dyes to disinfectants. Not all these products are contained in the coal tar itself. Only about a dozen simple or primary products come from the coal tar, but from these the chemist is able to make thousands of new substances.

Some of the most important substances made from the primary coal-tar products are dyes. A whole rainbow of colors is made from coal tar. Indeed it is possible to make from this substance practically any tint or shade desired. More than nine hundred different coal-tar dyes are in common use. These dyes not only make attractive our stockings, dresses, ribbons, and hats, our Easter eggs and our valentines, but they also give the pleasing colors to many of our candies, jellies, and drinks.

Some of the coal-tar dyes serve a very interesting



VARIOUS COAL-TAR PRODUCTS

purpose besides that of giving color. "Brilliant green," "crystal violet," "Victoria blue," and other dyes are used as antiseptics to keep wounds from becoming infected. One permanent yellow dye is used as an antiseptic to cover burned skin. During the World War the patients in military hospitals were often "decorated like Easter eggs" with these antiseptics. The discovery of these new antiseptics obtained from coal tar made it possible to save the lives of many more of the wounded than was possible in former wars.

Many important medicines and drugs are made from coal tar. Carbolic acid is a widely used drug, made from coal tar. One drug which the dentist uses to deaden the nerves in the gum when he pulls a tooth is made from coal tar. Disinfectants, sold under commercial or trade names, are also made from this useful material.

Don't you think it strange that the substance which gives us medicines for healing wounds should also give us the explosives which cause many of these wounds? Coal tar is used in making both an acid with which bombs are filled and a powerful explosive, called T. N. T.

This same coal tar furnishes us with flavoring extracts. It gives us an oil which scents much of

our toilet soap; it gives us many other cheap perfumes. Saccharin, a substitute for sugar, which is about three hundred times as sweet as cane sugar, is derived from coal tar.

One of the newest materials made from coal tar is "bakelite." It is a resin-like material which can be easily molded and machine stamped. After it is heated, it becomes very hard and as smooth as glass. It is waterproof and is not affected by heat, water, gases, acids, or electricity. These qualities make bakelite useful in building electrical machinery. The doors of radio cabinets are usually made of bakelite. Can you tell why?

Wood, paper, cardboard, cloth, and sawdust are soaked in solutions of bakelite and changed by heat and pressure into tough and hard materials.

By a different process bakelite may be made into a material colored like amber, but stronger and more brilliant than amber. It is used in the making of such articles as pipestems, cigar holders, beads, umbrella handles, and fountain pens.

Another coal-tar product is used for making phonograph records, buttons on United States navy uniforms, and eyeglass frames. Some common coal-tar products are cresol for preserving lumber, tar for roofing, tar paper, and paving materials.

BEEHIVE OVENS

Besides the articles which you have read about, thousands of other things are made from what was once a waste product of coke. Coal tar has made it possible for us not only to have many new products, but also to enjoy many products such as certain dyes and perfumes which were formerly too expensive for common use.

A great deal of this useful raw material is still wasted in the making of cheap coke. This is because much of our coke is made in ovens which do not collect the gas and coal-tar vapors

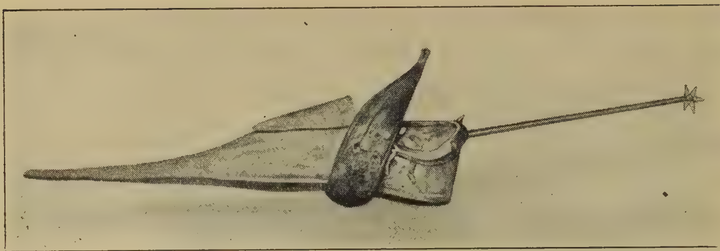
as do the by-product ovens. These wasteful ovens are called "beehive ovens," from their shape. In the picture of the beehive ovens on the opposite page you can see how the gas and vapors burn at the upper opening and so are wasted. Beehive ovens not only waste the gas and other vapors, but they also make poorer coke and less of it from the same amount of coal than do the by-product ovens. A few years ago all of our coke was made in beehive ovens. Each year the number of by-product ovens increases.

CAN YOU EXPLAIN THESE?

Having read the article about coal-tar wonders, you should be able to explain (in a few brief sentences) each of the words and phrases given below. If you cannot give a clear explanation of each of them, turn back to the lesson "Coal-Tar Wonders" and find out about them.

coal tar	vapors	saccharin
coke	antiseptic	by-product oven
T. N. T.	bakelite	beehive oven

gases given off when coal is burned in a closed oven
primary products of coal tar
substances made by chemists from primary products



AN EARLY FIFTEENTH-CENTURY SHOE

THE CARE OF THE FEET[1]

How should you like to wear shoes with toes so long and narrow that they must be looped up and tied at the knee? In the thirteenth and fourteenth centuries knights wore these awkward shoes and thought themselves very fine indeed. But so much leather was wasted in the long toes of these shoes that laws were passed threatening with fine and imprisonment anyone who wore them. The fifteenth-century shoe shown in the picture above has a much shorter toe than many of the shoes which were looped up and tied at the knee. These shoes were not only awkward, but they were also uncomfortable. They were not shaped to fit the foot; a shoe would fit one foot as well as the other. It has been less than one

[1] Adapted from Andress and Evans, Health and Good Citizenship.

hundred and fifty years since shoes were first made with a "right" and a "left."

In recent years a great deal of study has been given to making shoes which are both comfortable and attractive. Today it is possible for anyone to have such shoes.

In spite of the fact that it is possible to wear comfortable, well-fitting shoes, many people do not. Indeed, most grown-up people suffer from foot troubles caused by wearing shoes which are too short, too narrow, too pointed at the toe, or too high-heeled. Such improper shoes cause corns, bunions, and broken arches. Boys and girls, too, are often handicapped by wearing the wrong kind of shoes. Improper shoes may spoil a boy's or a girl's chance of being a good runner or a good basketball player. They may make a child walk with his head thrust forward; they may make his spine crooked.

Do you wear the right kind of shoes? Do you know the points to consider in buying properly-fitted shoes?

The lesson "Shoes and Health" will help you to choose proper, well-fitting shoes, for it gives the points to consider in buying the right kind of shoes. What are these points?

SHOES AND HEALTH

We are horrified at the way the Chinese once bound the feet of baby girls, making them cripples for life, yet here in America we wear such ill-fitting and improper shoes that very few people are free from foot troubles.

The American Indian seldom had any trouble with his feet, because he wore moccasins which gave plenty of room for his feet. The civilized Indian who wears the white man's shoes also shares with him in having foot deformities. It is said that the early Egyptians had beautiful feet because they wore sandals, which they removed whenever they entered the house. The muscles of their feet were free to develop.

When a baby is born, his feet are nearly always in excellent condition. It is only grown-up people who are troubled with corns, bunions, callouses, and broken arches. Most of these foot troubles might have been prevented if the grown-ups who suffer from them had worn proper shoes when they were children.

Children's feet are easily bent and pressed out of shape by improper shoes. Almost every foot trouble from which grown-ups suffer began before

THE BONES OF THE FOOT, SHOWING THE ARCH

APPEARANCE OF THE ARCH WHEN HIGH-HEELED SHOES ARE WORN

they were twenty years old; so the kind of shoes that children wear is very important.

If we understand how the human foot is made, we can see how easily the wrong kind of shoes can deform it.

A healthy, normal foot has twenty-six bones, which are arranged so that there is an arch under the instep. The bones of this arch are held together by muscles and ligaments. At each step this arch "gives" like a spring, making walking easy and light. In a normal foot this arch is easily able to bear the weight of the body.

One of the principal causes of foot trouble is a breaking down of the arch of the foot. This happens when the muscles or ligaments weaken and let the top of the arch down. The nerves and blood vessels underneath are injured. Not

AN X-RAY PHOTOGRAPH SHOWING DEFORMED FEET CAUSED BY WEARING SHOES THAT WERE TOO SHORT AND TOO POINTED

only is the pain severe, but it may also spread through the legs and to the back. Many people who think they are suffering from rheumatism find that the pain is really caused by a fallen arch.

One cause of weakened arches is ill-fitting and improper shoes which do not give the muscles of the foot a chance to be exercised. High heels cause a great deal of arch trouble. They throw the weight of the body forward on the toes, pressing them uncomfortably into the toe of the shoe and causing too much strain upon the arch of the foot. The weight of the body should rest


A SENSIBLE SHOE

Photograph used through the courtesy of Rice and Hutchins

upon three points: the heel, the base of the big toe, and the base of the little toe. The illustration on page 235 shows how the arch is propped up on end by high-heeled shoes. Furthermore, in the effort to keep the body balanced, bad and ugly habits of posture are often formed. Very few girls who wear high heels stand straight or walk gracefully.

The shoe which is too short causes pain and tends to crowd the big toe over on the little ones. Shoes which are too narrow or too pointed crowd the toes, press the bones out of shape, and cause bunions, corns, and ingrowing nails. The illustration on page 236 shows what happens to the bones of the feet when such shoes are worn.

Almost all foot troubles come from improper and ill-fitting shoes. For this reason, shoes should be wisely chosen. When boys and girls are having shoes fitted they should notice the following things:

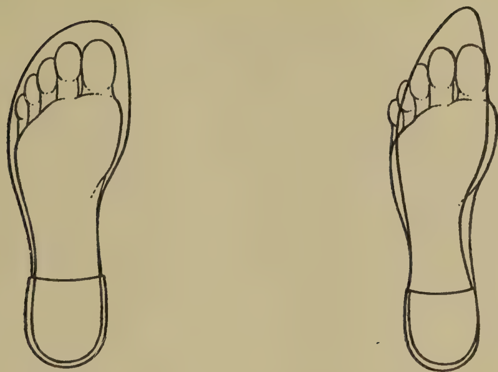
1. *Length.* The shoe should be long enough so that when one stands there is some space extending beyond the big toe. Colonel Munsen of the United States army says that when supporting the full weight of the body, as in walking, the foot is one inch longer than when the body is seated.

2. *Width.* The shoe should be wide enough for the toes to move around with ease. The foot is also wider when we stand than when we are sitting.

3. *Shape.* The shoe should have a straight inner line from toe to heel. The great toe should be able to point straight ahead.

4. *Heels.* The heels should be rather low and broad.

Accidents are sometimes caused by shoes with high heels. Many women have fallen going up and down stairs because their high heels caught on the edge of a step. The high, narrow heel wabbles and is likely to turn the ankle, causing a sprain.



WHICH KIND OF SHOE WILL YOU WEAR FOR COMFORT AND HEALTH?

5. *Kind of leather.* Patent leather is the most undesirable leather because the air cannot circulate through it. This causes the feet to perspire and feel very uncomfortable. Soft, porous leather is better for shoes.

6. *Cut of shoe and weight.* A low shoe is better than a high one, because it gives no support to the ankle and there is less pressure on the foot. When the weather is wet or cold, woolen stockings or gaiters should be worn for protection.

ILLUSTRATING A TALK WITH OUTLINE DRAWINGS

Choose one of the points to consider in buying the right kind of shoes, to report to the class. Explain all the ways in which shoes which fail

to meet this requirement may injure the wearer. Your explanation will be clearer if you make outline drawings on the board as you talk. The drawings at the top of page 239 might be used in a talk on "The Width of Shoes." Use outline drawings in giving your talk. Make your drawings as rapidly as possible so that your audience will not be kept waiting. Refer to the lesson as you prepare your report.

TEST

1. Tell briefly what should be remembered about each of the six important points to be considered in buying the right kind of shoes.

2. Why is it particularly important for children to wear the right kind of shoes?

3. How many bones has the normal human foot?

4. How are these bones arranged and held together?

5. Why does a fallen arch cause pain?

6. Why do high heels cause bad posture?

7. Upon what three points of the foot should the weight of the body rest?

8. How much longer is the foot when supporting the full weight of the body than when the body is seated?

AIDS TO FOOT COMFORT

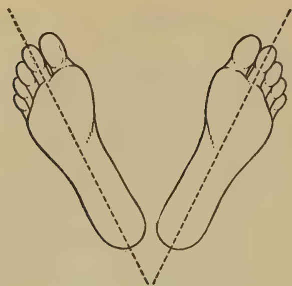
Fitting the feet with correctly shaped shoes will prevent most foot troubles. But there are other things which we can do to make the feet more comfortable and to keep them in good condition. What ways of caring for the feet are told in this lesson?

Stockings which fit well add a great deal to the comfort of the feet. Stockings should be long enough so that the foot does not feel pinched when one is standing, and should have no knots or rough darns. Blisters and corns often form where knots and darned places rub on the foot.

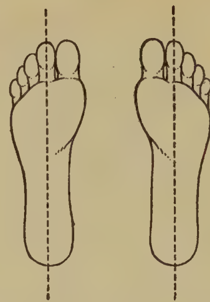
After a day's walk, wash and dry the feet carefully and put on clean stockings. If the feet are swollen or hot, wash them with warm salt water. Talcum powder is good to use on the feet.

If a blister forms, bathe the foot in hot water, then take a clean needle and prick through the skin at the side of the blister. Gently press out the fluid until the blister is flat. If the skin is broken, wash the blister with iodine to prevent infection.

The toenails should always be cut square and should extend beyond the soft flesh in order to protect the toes.



THE WRONG WAY TO POINT



THE RIGHT WAY TO POINT

Relief from ingrowing nails may often be had by placing a little pad of cotton between the nail and the flesh. Another way is to notch the nail in the middle so that the nail can spread when pressed sidewise.

One of the most common means of trying to secure relief from foot trouble is by the use of arch and ankle supports. These often do more harm than good if they are not properly fitted. They should be used only when carefully fitted by a foot specialist who has been trained to do this work.

The way we walk has a great deal to do with having good feet. At the top of this page are shown the correct and incorrect ways of pointing the toes in walking. Walking with the toes turned out puts the arch under great strain.

When the toes are pointed in the direction in

which one is traveling, the weight of the body falls forward and is distributed equally over the ball of the foot and the five toes. The weight is thus thrown on the outer side of the foot, where it should be. How do you walk?

TEST

If you read the lesson carefully you should be able to report on these topics:

A. What to do for the following foot troubles:

Blistered feet
Swollen feet
Ingrowing nails
Improperly fitted arch and ankle supports

B. The attention which should be given to each of the following things in order to keep the feet in good condition:

Stockings
Caring for the feet after a day's walk
Toenails
The way to walk

Turn back to the lesson and read again about the points which you do not remember very well.

EXERCISES FOR THE FEET

Exercising the muscles of the foot is important for two reasons. One reason is that it keeps the muscles strong and so prevents fallen arches. The other reason is that it strengthens the arches after they have already become weakened.

Boys and girls can prevent foot troubles and strengthen weak arches by exercising the muscles of the feet. Here are some good exercises for the feet. Read these exercises carefully so that you can do them.

1. Walk with the feet straight ahead, following a straight line, the heel and the great toe touching the line.

2. Walk on the heels with the feet straight, toes raised.

3. Rise on the toes. Then lower the heels slowly with the body weight on the outer sides of the feet.

4. Sit with the feet flat on the floor and parallel with each other. Raise the arch of the foot by trying to draw the toes toward the heel, turning the toes inward. The same exercise may be taken in a standing position.

5. Try to pick up with the toes such small articles as pieces of chalk, pencils, or marbles.

6. While sitting on a chair place the right leg over the left knee; bend the right foot downward and inward twenty times. Repeat for the left foot.

All standing exercises should be performed with the feet straight and about six inches apart.

TEST

This lesson gave directions for six good exercises for the feet. The value of these exercises depends upon following the directions accurately. Four of these can be done in the schoolroom without removing the shoes. Choose four pupils from your class to demonstrate these exercises. Let each pupil demonstrate one exercise. Watch carefully to see if it is done exactly right. You may show any pupil who makes a mistake how to do the exercise correctly.

Perhaps your entire class would like to do these exercises during a rest period. Practicing these exercises at home with shoes and stockings removed will help you to have strong and healthy feet.

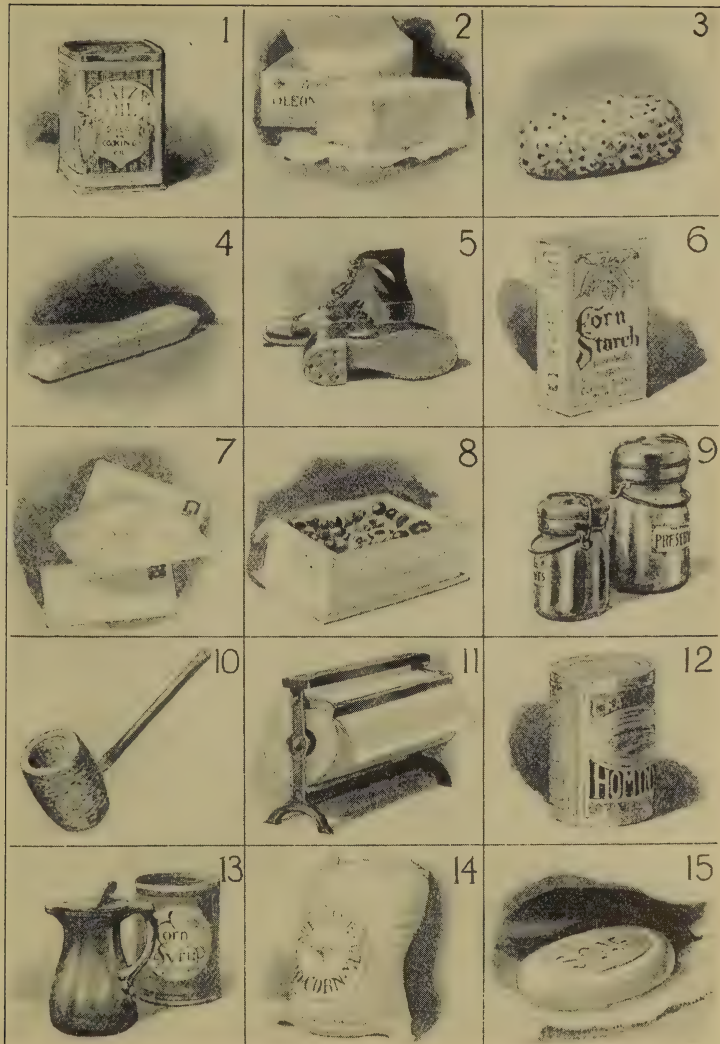
A TEST OF YOUR ABILITY TO OUTLINE A LESSON

Other lessons in this book have given you practice in making outlines. In making all these outlines you were guided by blank outline forms. How well can you outline a lesson when you do not have these helps to guide you? Test your ability by making an outline for Part I of the lesson "The Uses of Corn."

This outline will have one more step than those made in earlier lessons in this book. Study the form in the section of an outline below.

I. Products made from the kernel
- *A.* From the germ
  - 1. Corn oil whose products are
    - *a.* Cooking oil
    - *b.* Lard and butter substitutes
    - *c.* Glycerin
    - *d.* Soap

Read Part I of the lesson through once to decide upon the main divisions of your outline. Before you begin to write, skim through Part I a second time to see if you have overlooked any of the main points. Do not try to make your outline from memory. Refer to the lesson as you work.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OLEO
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Corn Starch
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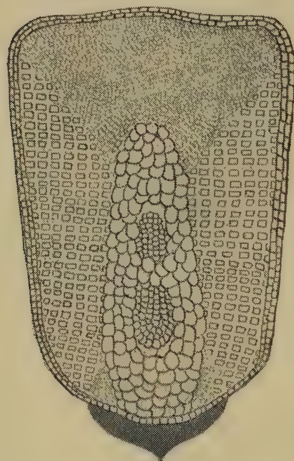


THE USES OF CORN

PART I

Does your pencil have a "red-rubber" eraser? Did you know that this eraser was probably made from corn? Did you know that "red-rubber" sponges, soles for shoes, and wrapping paper were corn products?

More than one hundred different products are made from corn. Every part of the corn — kernel, cob, stalk, and leaves — is used to make these different products.

If you split a kernel of corn in two you will find that it consists of three parts: a small oily germ at the point, a white body consisting mostly of starch, and a hard and horny hull on the outside. Find these parts in the diagram on the opposite page. Each of these parts of the corn kernel is made into different products.

From the germ, corn oil is obtained. This oil is refined and sold as table or cooking oil. Corn oil is also made into a vegetable substitute for lard and butter. The poorer grades of oil are made into soap, glycerin, and lubricating oil. A bushel of corn contains about a pound of oil.

Another product from the germ is a gum which is used as a substitute for rubber. The "red-rubber" sponges and eraser tips for pencils are made from this gum. It is also used in making rubberoid soles for shoes, automobile tires, and other rubber goods.

The substance which remains after the oil is pressed out of the germ is called corn-oil cake, or, when ground, corn-oil-cake meal. It is used to fatten cattle.

From the white body of the kernel two important products are obtained. These are starch and gluten.

Cornstarch is used in preparing many kinds of food. Have you ever eaten cornstarch pudding? Ask your mother about other ways in which she uses cornstarch. Another kind of cornstarch is used to stiffen freshly washed clothes.

The textile industries use cornstarch to stiffen and finish various kinds of yarns and cloth, and to fix dyes. The paper industry uses cornstarch for finishing the better grades of paper.

From the starch of corn a number of products are made. One of these, called dextrin, is used as a mucilage on our stamps and envelopes, and in the manufacture of the fireworks which are called sparklers.

Another product of starch is present in much of the candy you buy. This product is glucose, a very thick sirup, which is only about two thirds as sweet as cane sugar. When cane sugar is cooked, it sometimes forms into crystals, making the candy or jelly in which it is used grainy or sugary. Glucose does not form crystals. For this reason it is used in making candies, jellies, and preserves to keep them from becoming sugary or grainy. Several years ago glucose was made in such a way that it was not fit to eat, but this is

no longer the case. As it is now produced, glucose is in no way injurious to health. Glucose is found in grapes and in other ripe fruits, and it forms more than half of honey. Glucose mixed with about 15 per cent of cane sirup makes the corn sirup for table use and for cooking. Glucose is also used in the process of silvering glass for mirrors, in the manufacture of shoe polish, and as a filler for cheap soaps and for leather.

Corn sugar, made from cornstarch, is used in the manufacture of ice cream, in condensed milk, and for many other purposes.

During the war a product of cornstarch was used in the manufacture of explosives. This product, called nitro-starch, was found to be one of the safest of high explosives.

Alcohol can be made from cornstarch. At present, however, alcohol can be made so much more cheaply from other materials that very little cornstarch is used for this purpose.

Gluten, the second important product obtained from the white body of the kernel, yields vegetable glue and gluten meal.

The oily germ and the white starchy body of the corn kernel furnish most of the products made

from it, but the hard outer hull is not wasted. It is made into a bran which is mixed with gluten and fed to cattle.

Not only the kernel but also the stalk and leaves of the corn are made into useful products.

With the stalks and leaves mattresses are stuffed. The leaves are used for packing fruits and for weaving mats.

The pith of the stalk is compressed into blocks and packed under the armor plate of war vessels. If this armor is pierced, the pith will swell and stop the leak. Guncotton and smokeless powder are also manufactured from pith. At the present time very good paper is made from the pith of cornstalks. It is probable that in the future the entire stalk will be used in the manufacture of paper.

Even the cobs are not wasted. They are ground into a pulp which is used for stuffing mattresses. In parts of our country where much corn is grown, the cobs are commonly used as fuel in place of wood. Chemists have found it possible to make glucose from cobs, but this is not profitable at the present time, since glucose can be made more cheaply from other starchy or woody materials. A gum suitable for posting bills and for labeling

may also be obtained from cobs. Chemists are trying to discover other uses for cobs so that we shall not waste the millions of bushels which are now thrown away every year in the United States. Have you ever seen pipes whose bowls were made from corncobs?

TEST

Can you tell from what part of the corn each of the articles shown in the picture on page 247 is made?

Near each article is a number. Copy these numbers in a column along the left-hand side of a sheet of paper. Opposite each number write the part of the corn from which the article, or the corn product it contains, is made. Below is the way to show the part of the corn from which article 1 is made.

1. Germ

MAKING AN OUTLINE FROM MEMORY

Can you make an outline from memory? Read "The Uses of Corn," Part II, carefully to plan an outline. Before you begin to write, skim Part II to see if you have forgotten any points. Then close your book and write the outline.

THE USES OF CORN

PART II

Only a small part of our corn crop is made into the products described in Part I of this lesson. More than four fifths of the three-billion-bushel corn crop is fed to live stock on the farms. Not only the corn itself but also the dried leaves and stalks are fed as fodder. Corn which is cut before the juices of the plant begin to dry in the fall, and is stored in a building called a silo, makes a valuable food for stock. The entire plant — stalk, leaves, and ears — is chopped into short lengths by machinery and packed into the silo.

A large part of the corn which is not fed to live stock is made into human food. You are familiar with corn meal and hominy. Can you name other food products made from corn?

LEARNING TO MAKE A SUMMARY FROM AN OUTLINE

You have already made an outline of the points told in "The Uses of Corn," Part II. Try to tell these points in two summary sentences. Make one sentence about corn as food for stock. Make the other sentence about corn as human food.

SELECTING HEADINGS AND TOPICS

The lesson "The Story of Dyes" might be divided into parts. The first part might be called "Dyeing and Dyes in Ancient Times." Pages 148–150 tell about this part. The second part might be called "New Dyestuffs obtained in America." What pages tell about this part?

Each part tells about several topics. The topics discussed under Part II are listed below.

Part II. New Dyestuffs obtained in America
Dyewoods
Cochineal dye

Write a sectional heading for each of the parts into which you think the lesson might be divided, the pages which tell about each, and the topics included under each. Arrange your work like the example above.

DO YOU KNOW THE ANSWERS?

1. From what is turpentine made?
2. Where does the turpentine come from which we might buy for mixing with paint?
3. What is the most common use of turpentine?
4. Describe the steps necessary in getting turpentine ready for use.
5. How are the modern methods better than former methods?
6. What other things are made from the same material as turpentine?
7. For what are these other products used?
8. Describe the steps in making the other products.
9. Are more improvements in these industries possible?

In the next lesson you read you will find answers to the above questions. Read carefully straight through and then turn back and answer as many questions as you can.

THE NAVAL STORES INDUSTRY

In the great forests of long-leaf pine covering the level sandy coast plain of North and South Carolina, Georgia, Alabama, and Florida, the making of naval stores is one of the principal occupations. These naval stores are turpentine, rosin, pitch, tar, and creosote, and they are so called because they were once used largely in shipyards. They were more important to the navy when only wooden vessels were used than they are now in the time of steel vessels, for the seams and cracks in the boards of wooden vessels had to be calked with pitch and tar in order to be water-tight.

North Carolina is sometimes called the Turpentine State because it produces so much turpentine. The United States is by far the greatest producer of these naval stores; in fact, most of the world's supply comes from our Southern states. The United Kingdom, Germany, and Belgium are our largest customers, but ships take these products to all parts of the world from Savannah, which is the largest naval stores market in the world.

All these valuable naval stores are made from the sticky yellow liquid, or resin, which flows from the long-leaf pine tree when a cut is made in the

LONG-LEAF PINE TREES

trunk. This resin is not the real sap as maple sap is the sap of the maple tree, but it seems to be produced for the purpose of healing the cuts in the tree. As soon as a cut is made through the bark, the resin oozes out and covers the wound.

Photograph by Ewing Galloway

GATHERING RESIN AFTER IT HAS DRIPPED FROM THE WOUND IN THE TREE

The early method of gathering resin was to cut one or two deep pocket-like notches in the tree and let the resin, called the crude, run into the hollow at the bottom of these notches, or boxes. Since the resin hardened in a short time and stopped up the wounds, the gash had to be made deeper nearly every week all through the bleeding season, from spring to fall. This was done with a sharp blade called a hacker. Once a month the men dipped the crude and hauled it away. This way of

gathering the resin was very injurious to the trees. The deep cuts did so much harm to the trees that they lived for only four or five years after the first gash was made. The cuts also damaged the trunks so seriously that they could not be used for lumber after the trees died.

Through work done by the United States Forest Service a better way of collecting the resin has been found. Small shallow cuts are made in the tree trunk, and a metal trough or gutter is used to carry the resin from the cuts to a cuplike vessel underneath. This is sometimes an earthen pail or cup, which is put either at the foot of the tree or directly under the cuts. This new cup-and-gutter system is better than the old box system, first, because 20 per cent more gum can be obtained; second, because the trees live much longer; third, because when the trees die they are still useful for lumber; and fourth, because there is much less danger from fire. It has been found by the United States Forest Service that this new system has led to a saving of at least $4,000,000 annually.

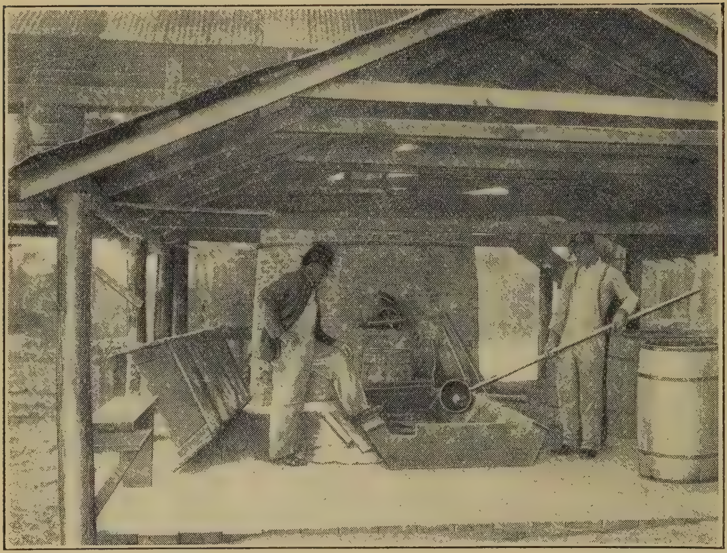
After the crude has collected in the vessels it is hauled away to a distillery, or turpentine still, where it is boiled with a little water. In this way the turpentine goes off as vapor just as steam

Photograph by Ewing Galloway

A MODERN TURPENTINE STILL IN THE SOUTH. THE RESIN FRESH FROM THE TREES IS UNLOADED ON THE UPPER FLOOR AND POURED INTO THE STILLS

passes off from boiling water. This vapor is sent through a coiled tube, called a worm, which is always kept cool under flowing water. When the vapor passes through this cold tube it turns back into a liquid. This liquid is spirits of turpentine, and the process of making it is known as distilling.

The remaining mass which is left after the turpentine is distilled out is rosin. This is run through a sieve into a trough and then is ladled into barrels while still hot. When it cools it turns hard, so that the barrels need not be very tight. Each barrel of



© Ewing Galloway

FILLING BARRELS WITH ROSIN

rosin must go through state inspection before it can be shipped. The head of the barrel is knocked off and a tiny cube of the rosin is cut out and placed on the top. Then the inspector examines it, holds it up to the light to note its color, and labels the barrel as to its quality. Turpentine is often stored in huge tanks on the docks and drawn off into barrels as needed. This also is done under state inspection.

Turpentine and rosin have many uses. Seventy per cent of our turpentine output is now used for

making paints and varnishes. Turpentine is also used in medicine and for dissolving gums and oils. Rosin is used in making soap, varnish, sealing wax, cement, the smooth finish for paper, and for putting on violin bows to keep them from squeaking.

Tar, pitch, and creosote — other products of the long-leaf or yellow pine tree — are obtained in a different way. When the chips of wood themselves are heated a long time, the sap oozes out sticky and black. This sap is then made into tar, pitch, or creosote. Tar and pitch are used for calking vessels, for making tarred paper, and for coating ropes to keep out the water and thus prevent rotting. Creosote is very valuable in preserving posts, poles, pilings, mine timbers, railroad ties, and other materials which are exposed to the weather and to growths which make wood decay. Creosote itself is a sticky black liquid. When the timber is put into a creosote bath the little pores, or openings in the wood, are filled up, and a good coat is made which will not let the timber decay.

Although the cup-and-gutter system is a great improvement over the old box method of gathering resin, later experiments are showing still better ways of getting naval stores. One department of the government has shown that all the

turpentine needed in this country can be made from dead trees, stumps, and sawdust. Only about one third of the wood in a tree really becomes lumber. The slabs which are burned or wasted around many sawmills, the small branches and tops which are cut off and left in the woods, and the rest of the waste all contain sap. Some ways have already been found to soak out all the sap from this waste-wood, and to use it for making naval stores. This leaves the pulp to be used for making paper. It has also been found that one kind of French pine gives more turpentine in a short time than our American pine does. The United States Forest Service is urging all turpentine producers to plant more of these French pines, especially on sandy stretches of land which otherwise are worthless. By these methods the United States may be able to keep up its record of naval-stores production and at the same time save its forests of Southern pine.

Now you will be interested to turn back to page 256 and see whether you can answer all of that list of questions. If there are still some which you cannot answer, skim through the reading until you can answer them all.

GIVING MEANINGS OF WORDS WITHOUT A DICTIONARY

This exercise consists of twelve words taken from the selection about naval stores with three possible meanings given for each word. You are to select the definition which seems to you to be the meaning of the word as it is used in the selection.

Do this one as an example:

1. Hacker
   a. The man who notches the trees
   b. The sharp blade with which notches are cut in the trees
   c. The man who hauls the sap away

Which definition is right?

In this example the definition after *b* is the right one. The way to show it is to write

1. *b*

In the exercise which follows you are to write the answers on your paper in this same way, picking out the right definition for each of the twelve words. Number them down the side of your paper and put the letter of the right definition for each one.

1. Rosin
   a. One of the products made from turpentine
   b. The sap before it is distilled
   c. The material left after the turpentine is distilled out

2. Distilling
   a. The process of turning into vapor and back into a liquid
   b. The oozing out of the sap from the pine tree
   c. The process of coating timbers with creosote

3. Worm
   a. An animal which spoils the yellow pine tree
   b. A coiled tube through which vapor passes in distilling
   c. The drill which is used for boring into the trees

4. Naval stores
   a. Places where naval stores are sold
   b. Turpentine, pitch, rosin, tar, creosote
   c. Places where naval supplies are stored

5. Resin
   a. The sap which oozes out of a cut in a yellow pine tree
   b. The material left after the turpentine is distilled out
   c. The material which keeps timbers from decaying

6. Boxes
   a. The articles used to take sap to the distillery
   b. The earthenware cups or pails to collect sap
   c. The deep pocket-like notches cut in the tree to collect the sap

7. Still
   a. The machinery for distilling
   b. A tree which no longer yields sap
   c. Quiet

8. Calk
   a. To make deep notches in the tree
   b. The bark of the yellow pine tree
   c. To make water-tight

9. Bleeding season
   a. The years during which the tree yields sap
   b. The time of year in which the sap flows
   c. The time of year in which the sap does not make good turpentine

10. Crude
    a. The sap as it comes from the tree
    b. The chips and waste wood before they are heated
    c. The turpentine before it is used in varnish, paints, or soaps

11. Ladle
    a. To put a mark on a box, barrel, or package
    b. To dip from one vessel into another
    c. The vessel in which the sap is collected

12. Spirits of turpentine
    a. Liquid turpentine distilled from sap
    b. The vapor which will turn into turpentine when cooled
    c. The gum as it oozes from the tree

FILLING IN A SKELETON OUTLINE

Since you have read the lesson about naval stores, it ought not to be hard to fill in the skeleton outline given below. The hardest part of this work is in putting down the answers in the shortest, best form possible. Usually a whole sentence is too long. Try to use a single word or a short group of words.

THE NAVAL STORES INDUSTRY

I. Products of the naval stores industry
  A.
  B.
  C.
  D.
  E.

II. States which produce naval stores
  A.
  B.
  C.
  D.
  E.

III. Countries which buy naval stores from the United States
  A.
  B.
  C.
  D.

IV. Methods of gathering resin
- *A.* The box method
  - 1.
  - 2.
  - 3.
  - 4.
- *B.* The cup-and-gutter method
  - 1.
  - 2.
  - 3.
- *C.* How the cup-and-gutter method is better than the box method
  - 1.
  - 2.
  - 3.
  - 4.

V. How turpentine is made
- *A.*
- *B.*
- *C.*
- *D.*
- *E.*

VI. How rosin is treated
- *A.*
- *B.*
- *C.*

VII. How tar, pitch, and creosote are obtained
- *A.*
- *B.*
- *C.*

VIII. Uses of the long-leaf pine products
   A. Turpentine
      1.
      2.
      3.
   B. Rosin
      1.
      2.
      3.
   C. Tar and pitch
      1.
      2.
      3.
   D. Creosote
      1.

IX. Improvements in the industry suggested by the government
   1.
   2.

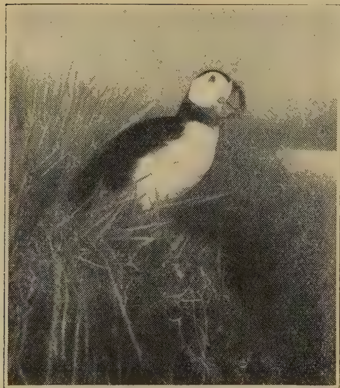
PROVING AN EXPLANATION TO BE RIGHT

You have proved statements by reading from the book in which you found the information. Have you ever tried to prove an explanation when your proof depended on things you had seen or discovered, rather than on facts from books? This is one way to convince anyone that such an explanation is right: First, take up in turn all other explanations that have been offered or that you think might be offered, and show why each is incorrect. Secondly, point out reasons which seem to show that your explanation is correct.

Mr. Chapman has used this method in answering a question that many people have asked about the greatest travelers in the world, the birds. Read "The Birds' Compass," Part II, carefully to see how Mr. Chapman makes his explanation seem convincing. These questions will help you:

1. What question is raised?
2. What answers besides the one Mr. Chapman believes to be right are suggested?
3. How does he show that each of these is wrong?
4. What is his answer to the question?
5. With what facts does he support his answer?

When you have finished reading, turn to Test I.



A PUFFIN

A MURRE

Courtesy of American Museum of Natural History

THE BIRDS' COMPASS[1]

PART I

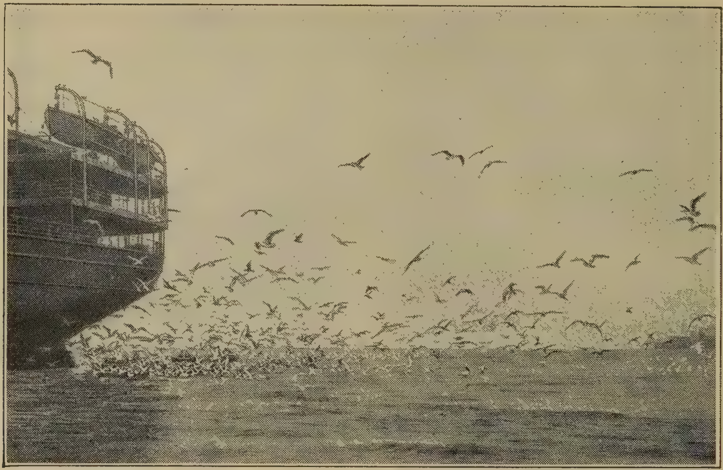
Have you ever been in a small boat offshore in a fog? It is not a pleasant experience. You venture out, perhaps to fish or sail, on some fine, clear day, when suddenly a bank of fog comes creeping in from the sea. Almost before you see it, softly, silently, swiftly, it surrounds you. The shore becomes dim and soon disappears. Probably you have no compass, and unless a fog siren, the wind, or the tide gives you a clue, you may soon be quite at a loss to say where the land lies.

[1] From "The Travels of Birds," by Frank M. Chapman.

Then you will be fortunate if somewhere near by there is a nesting colony of sea birds. In the Gulf of St. Lawrence, where I have had such an experience as I am describing, there may be murres, auks, or puffins. Off the coast of Maine we should find herring gulls. If we were near Nantucket we might expect to see terns.

If some of these birds also had gone out to fish at sea, when the fog came what would happen to them? The deep, bellowing roar of the siren could mean nothing to them. I doubt if they would notice the direction of either wind or tide. Nevertheless, bird after bird would go swiftly through the fog, returning to its home just as directly and surely as though it could be seen distinctly. Then if we were wise, like many fishermen before us, we would set our course by the birds and reach land in safety. So the birds would then be our compass. But what compass do they steer by?

Some years ago, when nearing the end of a voyage across the Atlantic, I discovered a curlew aboard the steamer. The season (it was in May) and the fact that several wheatears had also just taken passage with us showed that we had entered one of the birds' highways of migration.



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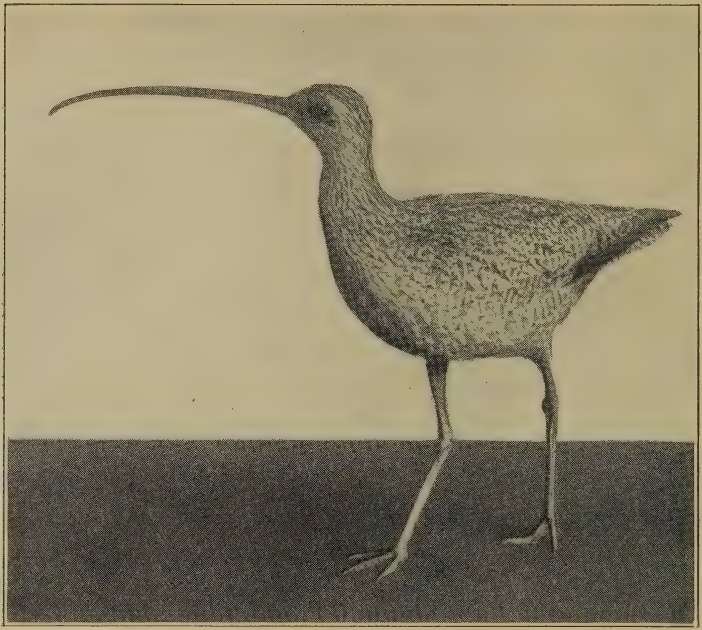
BIRDS LANDING ON A VESSEL AT SEA

The wheatear is a small bird about the size of a bluebird. It is one of the few birds which regularly travel from Europe to eastern North America. The first wheatears reach England from the South about March 1, but at that time they certainly could not continue their journey to Greenland and Labrador. Possibly, therefore, the early comers settle in England. If this is true, it is probable that the later birds are those which cross the Atlantic to nest in North America. Perhaps the very birds which had boarded our steamer were making this wonderful journey.

They seemed so small and weak when seen flying above the ocean over which they had embarked so bravely, that one could not believe their tiny wings were strong enough to battle with its storms. Then as one thought of the length of their journey over the trackless waters, it seemed even more remarkable that they should be able to steer a course which would bring them safely to the land for which they had started.

How do they do it? What is the secret of the power which guides them on journeys where man, without the aid of chart and compass, sextant and chronometer, would surely lose his way?

If the curlew did not give me an answer to this question, he had at least given me an exhibition of the confidence with which birds set out on voyages from which man, unaided, would shrink. The wheatears, when I walked too near them, flew to some other part of the steamer. Evidently they welcomed a lift on their long flight. But the curlew, as I attempted to photograph him at short range, without the slightest hesitation left his perch on one of the steamer's boats and flew out to sea. He did not swing around on the stern to follow us, but flew on ahead. There was no wavering in his course. With as much certainty



A CURLEW

Courtesy of American Museum of Natural History

as the man at the wheel pointed the steamer's bow toward the Irish coast, so did he point his bill toward land. He seemed to know where he was going. His speed was much greater than ours and soon he was lost to sight.

At this time Fastnet Light, the nearest land, was distant one hundred and forty miles. From the height at which the curlew was flying, the

horizon was distant not more than six miles. Even if his eyes were like telescopes he could not, therefore, have seen the coast. But if it had been so near that the beaches and marshes where he might find his favorite fare were in plain sight, he could not have started for them more directly. Small use had he for the steamer. Doubtless before we arrived he had found a hearty meal.

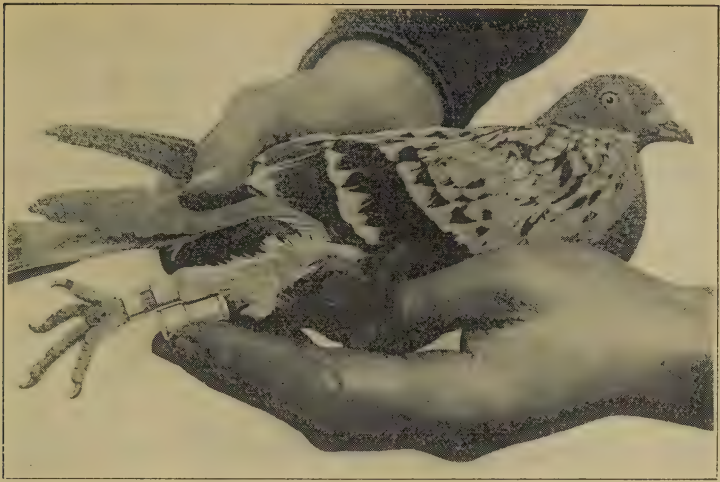
"Seeing is believing," says the old proverb, and this curlew, boldly, confidently striking out ahead of us with all our equipment for following the right route, seemed to prove that he was possessed of some special power which held him to the proper course.

But if it was surprising to see a bird start on a voyage of one hundred and forty miles, what should we think if we should see the turnstones begin their two-thousand-mile journey from Alaska to the Hawaiian Islands? Or what should we say of a golden plover as he began his two-thousand-four-hundred-mile flight from Nova Scotia to South America? Or how shall we express our amazement that tiny warblers, vireos, and flycatchers can wing their way through the blackness of the night and after traveling thousands of miles arrive on the date on which they were due?

So we repeat the question which people for years have asked before us — how do they find the way? Or, in other words, what is the birds' compass? Sight may be of assistance to birds on short journeys, but, as we have seen, it would be of small service over hundreds, not to say thousands, of miles of water. The sense of smell is poorly developed in birds, but in any case it would be of no value over the distances they travel. Their sense of hearing is very acute. When they are migrating they frequently utter their call-notes. Doubtless these serve to keep birds of the same kind together. But the leaders of a flock or company hear no calls ahead to guide them.

Taste and touch have certainly nothing to do with it. So we conclude that birds possess a sixth sense. This has been called the sense of direction. The sense of sight we know exists in the eye, and the sense of hearing in the ear, and in the nerves leading from these organs to the brain. But no one knows where the sense of direction is situated. Indeed, it is only within the last few years that naturalists have ventured to speak of a sense of direction as something which actually exists.

Sometimes this sense is designated as the "homing instinct." So we speak of the homing instinct



(ABOVE) A CARRIER PIGEON, SHOWING THE CASE IN WHICH MESSAGES ARE CARRIED; (BELOW) RELEASING A CARRIER PIGEON

of carrier, or homing, pigeons. But the homing instinct and the sense of direction are really two different things. The first impels the bird to start; the second guides it on its way. Everyone knows in a general way that when carrier pigeons are taken from their homes and released, they at once start on the homeward journey.

But, generally speaking, pigeons are at first taken for only a short distance, and they gradually learn to make long flights only after they have made shorter ones. The owner of the pigeons usually does not care to risk losing his birds by taking them so far from home that they may never return. But it is also true that the first homing flights of pigeons are often over routes which they have never seen before. The journey may be short, but, like the sea birds in the fog, they would not know what direction to take if something did not tell them, and this something is either the homing instinct or the sense of direction.

TEST

Plan a report showing how Mr. Chapman proves his explanation to be right. Use the following plan in preparing your report. Refer to the lesson if you cannot remember all the facts.

1. State the question.

2. State the answers with which Mr. Chapman does not agree. As you tell each one point out all the facts which the author gives to prove that this answer is not correct.

3. State Mr. Chapman's answer to the question and give the facts with which he supports his answer.

A REPORT TO MAKE

The book from which this lesson is taken answers many other questions which people have asked about the travels of birds. It tells so interesting a story that you will like to read the whole book. Where can you learn the name of the book? You will probably find a copy of the book either in your school library or in the public library. Plan to report to the class another interesting question and its answer from this book.

HOW ACCURATELY CAN YOU REPORT AN EXPERIMENT?

Part II of the "The Birds' Compass" describes several experiments which were made to find out whether or not birds have a sense of direction. Choose one of these experiments to report to the class. It is important to report an experiment carefully or you may give a wrong idea of it.

Read the lesson through once to choose the experiment you wish to report. Then study the part of the lesson you select, using the following outline to guide you in planning your report. Follow this outline carefully.

Points to be brought out in the report of an experiment:

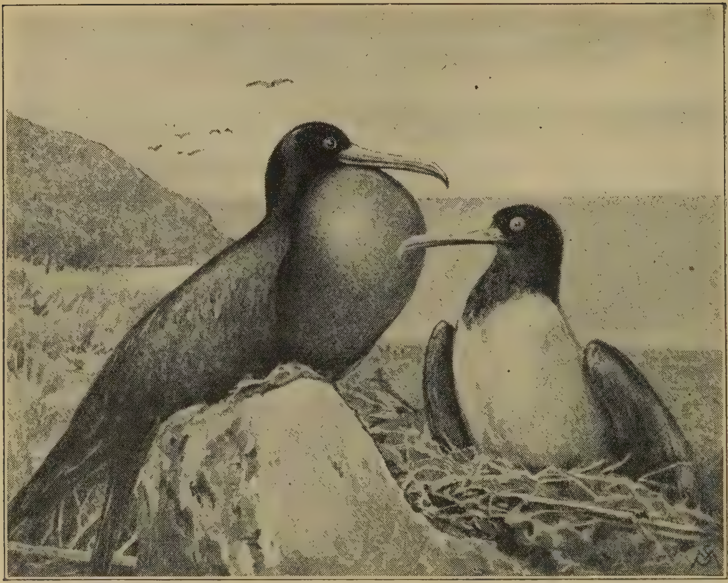
1. *The purpose of the experiment*
   Tell clearly what the person who made the experiment was trying to find out.
2. *The method of the experiment*
   Tell exactly how the experiment was carried out. Report all the details accurately.
3. *The result of the experiment*
   Tell exactly what happened when the experiment was carried out.
4. *The conclusion*
   Tell what the experiment seemed to prove.

THE BIRDS' COMPASS

Part II

Before the discovery of wireless telegraphy Captain Reynaud of France was forming a pigeon-post service for the French army. Among his experiments he released pigeons from steamers when they were out of sight of land. I still have a message which he sent me from the steamer on which he was returning from this country to France. Surely something more than sight was required to bring the bird that bore this message back to its home in New York City. It has been suggested that from the cage in which they were confined the pigeons might see the country through which they were passing. They could then, some people have supposed, remember the main landmarks and thus find their way back.

But there are not many landmarks at sea, and another experiment by Captain Reynaud clearly proved that pigeons can return to their homes over a country which they could not possibly have seen. In this experiment he took five pigeons, when they were under the influence of chloroform, from Orléans to Évreux, France, a distance



A PAIR OF MAN-OF-WAR BIRDS

of about seventy miles. After two days, when they had thoroughly recovered from the effects of the drug, they were released, and at once returned to their home in Orléans. These birds, therefore, were certainly not guided by anything that they had learned of the route while traveling to Évreux.

The natives of certain islands in the South Pacific use frigate, or man-of-war, birds for messengers. Probably this custom is of much older

origin than our employment of the pigeon. The frigate bird is a great wanderer. With wings which measure, when spread, about eight feet from tip to tip, its body is not much larger than that of a good-sized chicken. It can therefore remain in the air for long periods and, if necessary, make great journeys without resting. We cannot prove that the birds used as messengers on the Pacific had not in some manner learned the routes over which the natives sent them. But in the experiments which I am about to relate we know that the birds used had never before made the journey from the place where they were released to the place from which they were taken.

These experiments were planned by Professor Watson of Johns Hopkins University. The birds used were sooty and noddy terns. Many thousands of these birds nest on Bird Key, a tiny islet in the Dry Tortugas. In order that he might study their habits Professor Watson lived alone on the Key with them for three months.

Birds which know nothing of man generally have little or no fear of him, so Professor Watson was soon on friendly terms with the terns of this remote island. He could go among them and cause no more alarm than one would in walking

through a poultry yard. This tameness permitted him to learn many interesting things about their lives at home. He also made a number of tests to see whether birds which were taken some distance would return to it.

He caught several birds and with aniline dyes stained their feathers various colors in order that he might recognize them. First, he took three noddies. Some were set free only twenty miles, others sixty miles, from the Key. All returned within from one and three quarters to about three and a half hours after being given their freedom.

Then two noddies and two sooties, after being colored, were sent to Havana, a distance of one hundred and eight miles. They were released on the morning of July 11, and returned to the Key the next day. It may be said that these birds had flown over this route before, but in the next test the birds used were taken on a voyage over a part of the sea about which they could have known nothing.

On June 13 three noddy and two sooty terns were caught and marked, and sent from Bird Key to Key West. Here they were placed in the hold of a northbound steamer. They were carefully fed

Photograph by Herbert K. Job

A SOOTY TERN ON EGG

Photograph by Herbert K. Job

A PAIR OF NODDY TERNS ON NEST

and watered, and on June 16 were released about twelve miles east of Cape Hatteras, off the coast of North Carolina. This is about one thousand and eighty miles by water from Bird Key — a long journey even for the most highly trained homing pigeon. But the birds' compass pointed the way, and on the morning of June 21 both sooties were found on their nests, and one of the noddies was seen several days later.

Still we might say, as someone indeed suggested, that these birds simply followed the coast line until they reached their island home. Though why they should go south instead of north, or turn westward through the Florida Keys instead of eastward to the Bahamas, where many terns of their kind live, is not explained.

However, to make it perfectly clear that the birds were not guided by landmarks of any kind, Professor Watson finally sent several sooty and noddy terns across the Gulf of Mexico to Galveston. This city is distant eight hundred and fifty-five miles from the Tortugas, and the intervening water is unmarked by islet, shoal, or reef. Nevertheless, one of the birds returned to Bird Key in six, one in seven, and a third in twelve days from the time of release.

It is, therefore, practically certain that the birds used could not have been familiar with the route, nor could there have been other birds of their kind to guide them. From the hold of the vessel they certainly could not have observed the water over which they were sailing, and if they had, it would not have given them a clue to a return route. We can, therefore, explain their remarkable feat only by believing that they were guided by what we call the sense of direction.

No experiments that I know of seem to prove more clearly than these of Professor Watson that birds possess this sense.

Doubtless it is this sense which each year leads fishes to their spawning grounds and seals to their "rookeries." It appears also to exist to some extent in man, particularly uncivilized man. But man, besides being more intelligent than the animals below him, possesses powers of observation and reason which make him less dependent on the promptings of instinct than they are.

NOTE-TAKING IN A PROBLEM ASSIGNMENT

Sometimes it is necessary to read parts of several books in order to find the answer to only one problem. This lesson will show you how to take notes as you read so that when you have finished reading you will have a good answer to your problem. Suppose that you have this problem given:

Problem. How can the New England States, though they raise no cotton, still manufacture a large amount of cotton cloth?

Now take paper and pencil. Write the problem on your paper. As you read each different paragraph below, try to find all the reasons why the New England States can manufacture so much cotton cloth although they do not raise any cotton.

Here is the account which one book might give:

There are several reasons for New England's high rank among the other states in manufacturing. Power, one of the necessities in manufacturing, New England has in abundance from her rivers. Water-power is cheaper than any other kind of power. In those cities where there is more manufacturing than the rivers can furnish power for, coal is used to supply steam power. New England does not have coal of its own, but the great coal fields of Pennsylvania and West Virginia are not far away. Huge barges carry coal to the New England seaports to be used in the factories and

mills. Thus we see that New England has inexpensive power for manufacturing.

A manufacturing region also needs good methods of transportation. New England needs good transportation both for getting in the raw materials for manufacture and for sending the manufactured goods to market. With its good harbors and extensive railroad systems, New England is well equipped for bringing in the necessary materials for the factories and for getting its goods to market.

In what you have just read, what reasons did you find for New England's being able to manufacture cotton? How many reasons?

These are given:

1. New England has much cheap water power.
2. New England is not far from coal fields.
3. New England has good transportation both by water and by railroad for getting raw materials and for sending goods to market.

You should have the above reasons, but they may be in different words. Write them under your problem.

What other reasons for New England's high rank in the manufacture of cotton do you find in the next reading?

New England is particularly well fitted to manufacture cotton. In earlier times New England had the necessary water power, a moist climate which is necessary in handling

cotton, and enough labor, all of which were important in cotton manufacturing. Then, again, the people of New England were very intelligent and industrious, and they became skilled in this industry. Thus New England gained a reputation for the manufacture of cotton goods. This helps to keep the industry where it now is. Nearness to markets is also an advantage.

Massachusetts leads in the manufacture of cotton, but this is mostly due to the fact that she had an early start in this business.

Now add to your list of reasons for New England's high rank in manufacturing cotton. Write the reasons on your paper, but do not write any that you already have.

You should find at least five more reasons in the reading above. That will make eight in all. When you have finished your list of reasons, read it through to see if you can explain each point. Then you will have a good answer to the problem you started with.

THE STORY OF OIL

1. The last time you went for an automobile ride did you stop on the way to get some "gas"? And did you stop at one of those places along the road, called a filling station, where the man in charge of the pumps measures out to you as much as you ask for? And did the driver of your car say, "Better look at the oil, too"? Perhaps you have wondered what the oil and gas really are and where they come from.

2. Of course you know that the "gas" is really gasoline. It is made from petroleum. The oil which is used to keep the parts of the machinery running smoothly is also made from petroleum. Petroleum is one of our most valuable possessions.

3. Deep down in the ground, petroleum is widely scattered over the whole world. Russia, Mexico, Rumania, Dutch East Indies, Galicia, India, Japan, Peru, Germany, Canada, and Italy all produce petroleum. But the United States, with 443,000,000 barrels in 1920, was producing over eight tenths of the world's output. In the United States there is scarcely a state where signs of petroleum have not been found, but at present there are about nine principal regions from

PETROLEUM FIELDS OF THE UNITED STATES

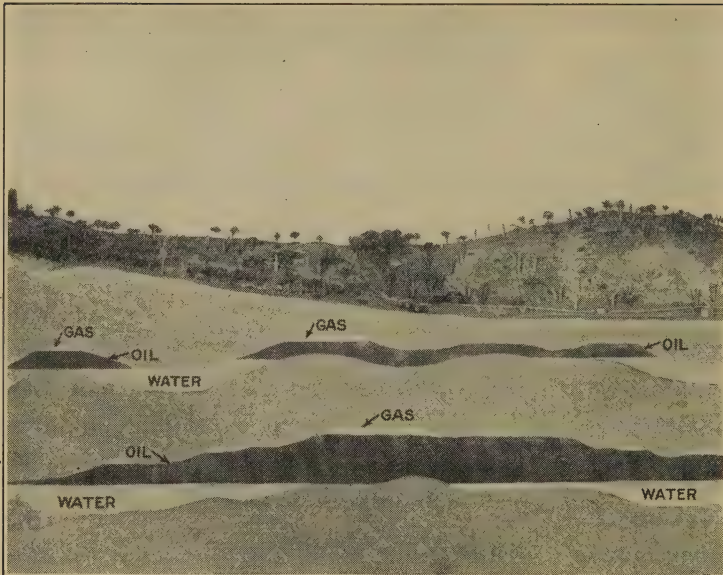
which we are getting our supply. These are shown on the accompanying map. In these regions new wells are being drilled continually, some of them very valuable and some not worth pumping.

4. Perhaps you are wondering how this petroleum, or rock-oil as it used to be called, happens to be in the rocks and why it is obtained only from these places. There has been a great deal of argument among scientists as to how petroleum was formed. Some say that it was made from a combination of different materials in the rocks themselves. But most people believe that both

petroleum and natural gas are the remains of decayed plants and animals. Dirt and gravel and rock covered these decaying materials for many thousands of years, and the great weight of the load on them and the heat from the earth below them together turned the matter into gas and oil.

5. In the early days of the petroleum industry it was supposed that the oil had collected in cracks and hollows in the rocks so that there were actual rivers and lakes of oil. We know now that this could not be true, since the great weight of the rocks above would not leave large hollows. Petroleum is *in* the rocks, not between them. We often say something is as solid as rock. But even rock has spaces between the particles of which it is made, and it is in these spaces and small pockets that petroleum gathers. Sandstone and limestone are the common rocks in which petroleum is found. If there were no cover to this rock which contains the oil, the petroleum would not collect there but would seep away and be scattered. And so we find that wherever petroleum is collected it is under a layer of rock which is not porous, so that the oil cannot flow through it.

6. Very often gas and petroleum are found together, but the finding of gas is not always a sign



THIS DIAGRAM SHOWS PETROLEUM DEPOSITS IN THE ROCK

that petroleum will also be found. The layers of rock in the earth are not all lying perfectly straight, but are folded and bent and twisted into underground hills and valleys. As oil rises through the porous rock, it gathers in the high or hill parts of these underground rock layers. These are the places where wells are valuable. But of course these underground hills and valleys are not always the same as the hills and valleys on the surface of the earth, so it is not easy to tell where to

THE FIRST OIL WELL

drill a well even in a region where there is known to be oil, and when other wells are successful.

7. The Bureau of Mines of the United States says that probably $30,000,000 is spent every year in drilling wells which turn out to be dry holes. Besides the difficulty in locating the oil-bearing rock, there is always the possibility that the oil

is not present in such form and quantity that it will pay to mine it. The oil region of Pennsylvania has been drilled more than any other region, but only a small part of it has given oil.

8. In olden times in the southeastern part of Europe around the Caspian Sea and the Black Sea, petroleum was used for lighting and heating. But the early colonists in America seemed to consider it a nuisance, for it was often found when they drilled for salt and they did not know what to do with it. Attempts were made to use it as a medicine. However, it first became useful as a fuel when it was discovered that this dirty liquid with the disagreeable smell could be purified so that it would light and heat buildings. The first successful well was drilled by Colonel Drake in 1859 on Oil Creek, Pennsylvania. Immediately wells were dug all along the valley for miles, and the first oil boom had begun.

9. As new uses were found for the petroleum and new ways were found for preparing it for use, more and more wells were drilled and new fields were discovered. In 1891, Pennsylvania reached its highest point with 33,000,000 barrels. Ohio, West Virginia, Kentucky, Indiana, and Illinois in turn began producing oil and have

A PETROLEUM FIELD SHOWING DERRICKS

passed their highest point of production. The fields of the South and West are today those of greatest production. The California field and the Kansas-Oklahoma field are usually rivals for first place.

10. On a trip through an oil field there are many interesting things to be seen. At first sight the field seems to have a great many windmills scattered over it. These are the derricks with which the wells are drilled. Often these derricks are not taken down when the well is finished, but remain standing over the well.

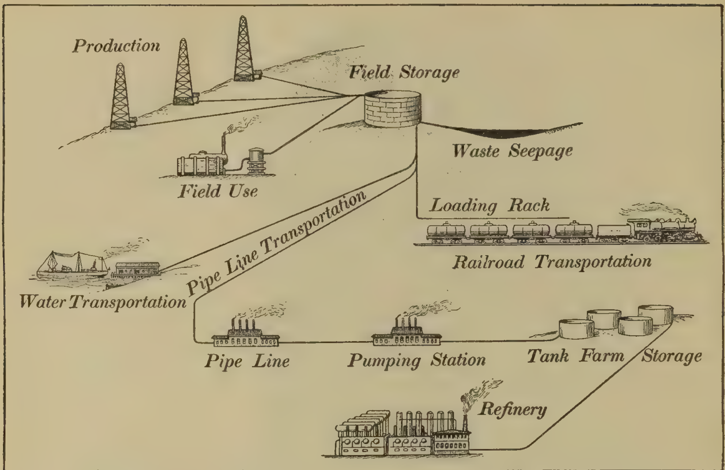
11. When the well is first drilled, the pressure of the gas with the oil is sometimes so great that it forces out the petroleum in a great stream that shoots high into the air. This is called a gusher. Gushers have been reported which ran up to 190,000 barrels per day. This is very wasteful, for the stream of oil often cannot be controlled and enormous quantities are lost. Flowing wells which do not have to be pumped, but which are not so hard to regulate as gushers, are very desirable.

12. As the gushers and flowing wells get older they usually have to be pumped. The pumps look a great deal like ordinary well-pumps, except that they do not have handles because they are not to be pumped by hand. Sometimes several neighboring wells are pumped by one central station. It seems strange to see six or eight of these small pumps scattered over a field, all pumping regularly, with not a person in sight.

13. In the early days of petroleum production wooden barrels were used for storing and transporting the oil. These were not satisfactory because they were bulky and they often leaked. In 1865 a pipe line was laid for five miles in one of the Pennsylvania fields. This seemed to answer

A GUSHER

the problem. Gradually more pipe lines were laid, until now nearly all the oil fields east of the Rocky Mountains send their petroleum by pipe lines to the refineries along the Atlantic or Gulf Coast. It is necessary with these pipe lines to have pumping stations at intervals of every few



OIL PRODUCTION, FROM DERRICK TO REFINERY

Courtesy of California State Council of Defense

miles to force the oil along. Huge storage tanks at the wells hold the oil until it can be sent out.

14. The map on page 294 shows the principal pipe lines in our country. Since transportation of petroleum by pipe lines is faster and cheaper than by other methods, those companies which have owned the pipe lines and refineries have grown to be the largest. From the refineries the products are sent in tank cars and tank steamers to all parts of the world.

15. The petroleum just as it comes from the well is called crude oil, or crude petroleum.

Some of it is used as machine oil; much is used as fuel, especially for locomotives on Western railroads. But most of it is refined. At the refineries the crude petroleum is distilled. It is heated until vapor, or steam, rises into the tube. This tube is kept cool, and as vapor touches the cold tubes it turns back into a liquid. But this new liquid has left the impurities behind and now is ready to be made into benzine for cleaning, kerosene for fuel and lighting, and gasoline for running motor-cars, trucks, airplanes, and boats.

16. The thick sticky oils and solid matter which are left after the distilling are made into many things. Vaseline, chewing gum, tar products such as tar paper and paving tar, grease from which to make soap and candles and salves, and the oils — light, medium, and heavy — which keep all kinds of motors running smoothly are some of the most important products.

HOW WELL CAN YOU TELL WHAT YOU HAVE READ?

Having read the article on how we get our oil and gas, you should be able to give a good report on each of the following topics:

How petroleum was formed
Where petroleum is found
Difficulties in locating oil
Early use of petroleum
How oil is taken from the ground
How oil is stored and transported
Uses of petroleum

A good report should have a clear beginning sentence which gives a definite idea of what you want to explain; it should have a good main part, telling in plain, exact sentences the ideas which you want to explain; and it should have a good ending sentence.

Sometimes a topic report can be made very interesting through the use of maps, charts, or rapid sketches on the blackboard. Would some of the above topics be made more interesting in this way?

Try to plan at least one good report from the topics suggested.

HOW WELL DID YOU UNDERSTAND THE WORDS IN THIS LESSON?

If you understand all that was in the lesson you have just read about oil and gasoline, you should be able to give a good explanation of the meaning of each of the difficult terms given below. If you cannot, go back and study out the meanings from their use in the lesson.

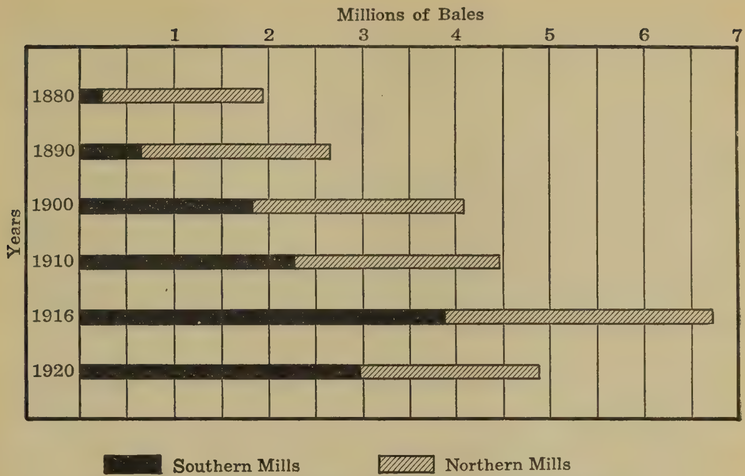
world's output	oil field
oil-bearing rock	derricks
seep	gusher
porous rock	flowing well
layers of rock	pipe line
underground hills and valleys	transporting oil
dry holes	storage tanks
oil boom	crude oil
highest point of production	medium oil
rivals for first place	refineries

LOCATION OF THE COTTON MILLS IN THE UNITED STATES.
EACH DOT STANDS FOR ONE MILL

ANOTHER LESSON IN TAKING NOTES

If you remember the lesson about manufacturing cotton in New England you will be interested in this map at the top of the page. Does this map show that New England must make a great deal of cotton cloth? Is there another section which manufactures a great deal, too? How do these two sections compare in the number of mills?

The chart at the top of the next page tells more about these two great sections which make our cotton cloth.



COTTON USED BY UNITED STATES MILLS, 1880–1920

How much raw cotton did Southern mills use for manufacturing in 1880? Can you tell from the chart?

How much did Northern mills use?

Which used the more in 1880? in 1920?

In what year did the Southern mills and Northern mills together use the most cotton?

Which used the more that year?

This chart shows the very rapid development of cotton manufacture in the Southern states. In 1880 they used a very small part of the cotton crop which they raised. Now they rank high with the New England States in this industry.

There must be some good reasons for this rapid growth of cotton manufacture in the South. In the explanations given below, try to find as many reasons as you can. Write them on your paper in answer to this problem:

Problem. Why have the Southern states been able to make such rapid growth in the development of the cotton-manufacturing industry?

1. Leading centers for making cotton cloth are New England, North Carolina, South Carolina, Georgia, and Alabama. For many years New England has excelled, Fall River and New Bedford being the chief manufacturing cities. Here the climate is more moist and even than elsewhere in New England, and coal barges can deliver coal at the factory wharves at low cost.

The rapid growth of the cotton-manufacturing industry in the Southern states is due to the nearness of the cotton fields and the development of electricity from the water power along the fall line to run the mills.

Alabama is becoming more and more a maker of cotton cloth. The cotton for her mills is grown at home, and the fuel to run them comes from Alabama coal fields.

2. The cotton-manufacturing belt of the Southern states is located near the fall line where there are many waterfalls. This has made cheap power. In Alabama the rich coal fields have also aided in furnishing inexpensive power. No other cotton-manufacturing region in the world has its power and its cotton fields so conveniently at hand.

Photograph by Ewing Galloway

COTTON FIELDS AND COTTON MILLS ARE SOMETIMES CLOSE TOGETHER IN THE SOUTH

Cheap labor was an important reason for the development of cotton manufacturing in the South. In the Appalachian Mountains there was a large population with not many chances for work. When the cotton mills opened, these people came in large numbers, so that there were always plenty of workers.

You should have found four different reasons for the South's great increase in cotton manufactures. Be able to explain each one of them.

AN ATHENIAN RUNNER

SPEED ON LAND

Both from necessity and for pleasure man has always traveled. Very often it is important to get to the end of the journey as quickly as possible. Sometimes to reach a place quickly is a matter of life or death. Even in traveling for pleasure most people seem to get a kind of joy out of going fast.

In the earliest periods of history uncivilized men had no way to travel except on foot. They could walk or they could run. We do not know how fast people could walk or run in those days.

The Greek historian, Herodotus, gives perhaps the earliest information concerning the speed of running and walking among ancient peoples. In his day the men who lived in the Greek cities of Athens and Sparta spent a great deal of time in sports and in training for these sports. Once when Athens was in danger of being destroyed by the Persians, the Athenians sent their fleetest runner to Sparta to ask for aid. The distance between these two cities is about one hundred and fifty miles. Herodotus tells us that the Athenian runner reached Sparta the day after he left Athens. Herodotus does not say how many hours he ran and how many hours he rested.

When the Spartan army finally set out it made great haste to reach Athens in time to aid the Athenians. The Spartans arrived in Athens on the third day. We do not know how many hours a day they marched, but to walk one hundred and fifty miles in three days is making very good time.

Although we do not know exactly how fast men walked or ran in the time of the Greeks, all that we do know leads us to believe that our modern runners make better records. For many years the records made by athletes in this country and in other parts of the world have been kept. The

FINISH BY PORRITT OF OXFORD UNIVERSITY IN THE ONE-HUNDRED-YARD DASH

records given in this book are the best which had been made up to the year 1924.

The best time that anyone has made in walking 1 mile was made in 1910 by G. P. Goulding of Canada, who walked 1 mile in 6 minutes and $25\frac{4}{5}$ seconds. In 1905, G. E. Larner of Great Britain walked 8 miles and 438 yards in exactly 1 hour. This distance is almost $8\frac{1}{4}$ miles.

By running, of course, men can go very much faster. In 1923, P. Nurmi of Finland ran 1 mile in 4 minutes and $10\frac{2}{5}$ seconds. In 1904, A. Shrubb of

Photograph by Ewing Galloway

A SKATING RACE

Great Britain ran 10 miles in 50 minutes and $40\frac{3}{5}$ seconds. The longest distance that anyone has been able to run in 1 hour was made in 1913 by J. Bouin of France, who ran 11 miles and 442 yards in 1 hour. For short distances athletes can run very much faster.

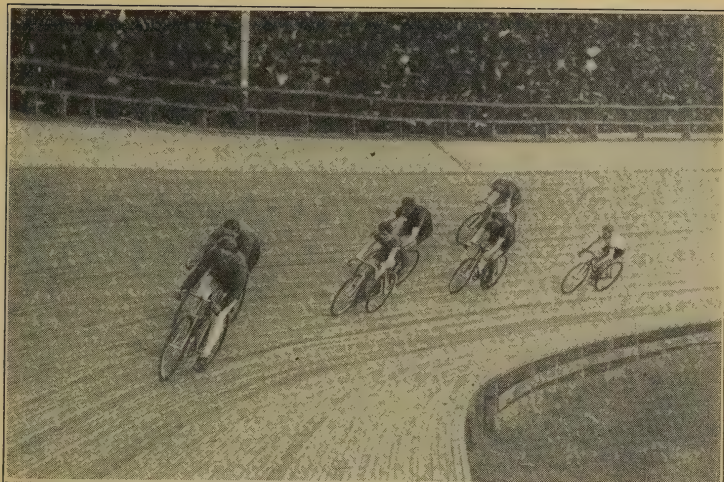
The swiftest skaters go very much faster, after the first few yards, than do the swiftest runners. Anthony Staff of the United States has skated a mile in 2 minutes and 35 seconds. V. Bergstrom of Stockholm has skated 10 miles in 31 minutes and

A RUNNING RACE

$7\frac{1}{2}$ seconds. However, for 50 yards a skater cannot beat a runner. It takes time to work up speed.

One of the earliest methods of getting over the ground faster than a man could go on foot was riding a horse. The fastest time that any horse has ever made in running 1 mile is 1 minute and $35\frac{2}{5}$ seconds. Horses have run faster than this for short distances but they cannot keep up their fastest speed over long distances. In races, horses rarely run more than 2 miles.

One horse, Dan Patch, paced 1 mile in 1 minute and $55\frac{1}{4}$ seconds. A mile is the usual distance



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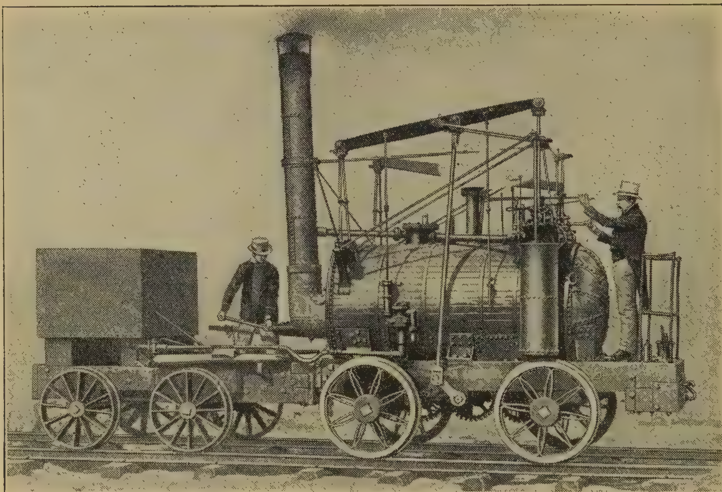
A BICYCLE RACE

for pacing horses to go in a race. The records show that trotting horses are just a little slower than pacing horses for the same distances.

With the coming of the bicycle there was for a time a great deal of interest in bicycle racing. One man rode 1 mile in 1 minute and 51 seconds. You can see that a man riding a bicycle can go a little faster than the fastest pacing or trotting horse, but not quite so fast as a running horse.

Sometimes bicyclists ride behind an automobile. They can make better time this way because the



A COPY OF THE FIRST LOCOMOTIVE

automobile breaks a way for them through the air. One man, riding behind a car, but of course not holding to it, rode 1 mile in 1 minute and $4\frac{1}{5}$ seconds. In 1 hour, riding behind a car, one bicyclist rode 50 miles and 3 yards.

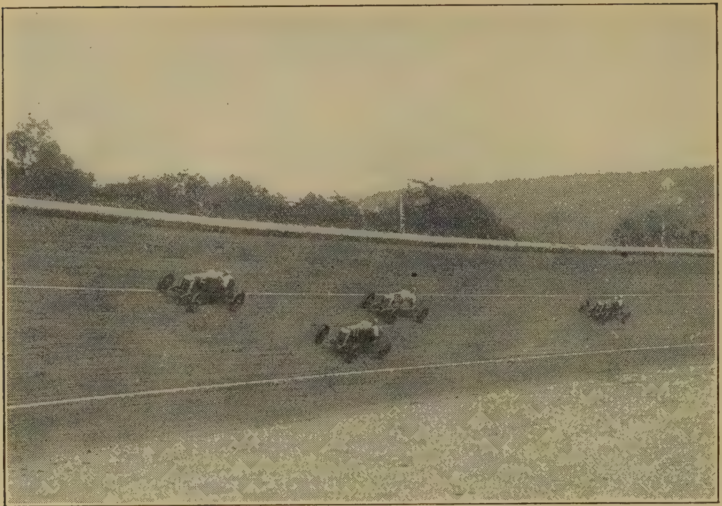
From our point of view, the earliest trains made very little speed. It took the first locomotive ever built 4 hours and 5 minutes to travel 9 miles. It was carrying 10 tons of iron, 5 wagons, and 70 men. The engine, while it was working, went nearly 5 miles an hour. This rate of speed was soon improved slightly. However, people of the

Photograph by Ewing Galloway

THE TWENTIETH-CENTURY LIMITED

time thought that a rate of 10 miles an hour not only was unlikely, but would be dangerous. One man wrote that "grave, plodding men will be flying about like comets," and "the whole gravity of the nation upset," and finally that "it is a pestilentious, topsy-turvy, harum-scarum whirligig."

Today the fastest trains, such as the Twentieth Century Limited, can make very high speed, but in general their speed is kept moderate in the interest of safety. The Twentieth Century Limited makes the trip from New York to Chicago, a distance of $960\frac{1}{2}$ miles, in 20 hours. This is at the



AN AUTOMOBILE RACE

rate of 48 miles an hour, including time for stops. The fastest time made by any train is 1 mile in 30 seconds. This means traveling at the rate of 120 miles an hour.

The best time made by an automobile for 1 mile is about $28\frac{3}{4}$ seconds. For 100 miles the best time is 49 minutes and 30 seconds. Of course, such records are made by racers. None of the cars sold for ordinary use could make such speeds. However, most automobiles can go faster than is safe either for those who ride in the cars or for other people. It is now generally recognized that no car

should be driven faster than 15 miles an hour in the busy section of a city, or 25 miles an hour in the residence district. Most states now set the speed limit in the country at 35 miles an hour.

For many years the motorcycle has been a favorite racing machine. The fastest motorcycle time for 1 mile is about $32\frac{1}{2}$ seconds. For 100 miles the best record is 60 minutes and 11 seconds. You can easily see why motorcycles are used by policemen to overtake speeding cars.

HOW WELL CAN YOU FIND AND USE NUMBERS?

1. How fast did the Spartan army march?
2. What is the fastest record for walking a mile?
3. What is the record for running a mile? How much faster is this than the walking record?
4. How does the greatest distance ever walked in an hour compare with the greatest distance run in an hour?
5. What is the record for skating a mile? How much faster than running is this?
6. What is the best time in which a horse has ever run a mile? Is this faster or slower than the skating record?

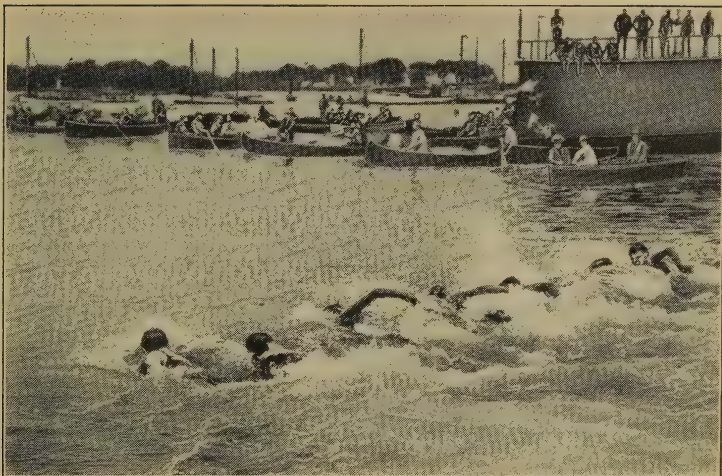
7. Which is faster — the record for a running horse or the mile record for a man on a bicycle?

8. About how much time did the bicycle rider save by riding for a mile behind an automobile?

9. Which is faster — the rate of the first locomotive or the record distance for walking a mile?

10. Which travels a mile in the shorter time — a racing automobile or a motor cycle? Which travels 100 miles in the shorter time?

11. One man walked 1 mile in about $6\frac{1}{2}$ minutes, but it took another man 60 minutes to walk about $8\frac{1}{4}$ miles. It took one man a little over 4 minutes to run a mile, but another man took over 50 minutes to run 10 miles. Why is it not possible to walk or run long distances at the same rate short distances are traveled? Can you show that this is true in skating?



A SWIMMING RACE

SPEED IN THE WATER AND IN THE AIR

Before man had boats of any kind, he could cross deep water only by swimming. It is not possible to swim even so fast as one can walk. The fastest time yet made in swimming 100 yards is $51\frac{2}{5}$ seconds. Most of the best swimming records for men, as well as for women, have been made by swimmers from the United States. For 1 mile the best record is 22 minutes and 34 seconds. Swimming is a sport in which women do very nearly as well as men.

Going by boat has always been a favorite way of traveling. Herodotus gives us an account of one of the first long voyages ever made by man. About six hundred and fifty years before the birth of Christ, when the Phœnicians ruled the ancient city of Carthage, a fleet was sent out which is believed to have sailed around the entire coast of Africa. This expedition was gone three years. Each year the sailors landed and sowed and harvested a crop of wheat before going on. Boats at that time were propelled chiefly by oars.

In Columbus's day sailing vessels were well known. These were rather crude. By 1850 American shipbuilders had built a type of ship which they called the "clipper." Not even the steamboats of that time could surpass in speed these beautiful ships. The swiftest clippers, in a favorable wind, would sail 18 miles an hour. At that time the fastest ocean steamships could go no more than 14 miles an hour.

For about twenty years it was a question whether the wooden clippers or the steel steamships would win the race for high speed. By 1850 this question had been decided in favor of the steamship. By 1890, the fastest steamships

© Ewing Galloway

A CLIPPER

A MOTORBOAT RACE

were able to cross the Atlantic in 6 days, as compared with 9 days required for this voyage in 1850. In 1924, the *Mauretania* went from New York to Plymouth in 4 days, 21 hours, and 57 minutes. This ship has made an average speed of more than 26 knots, or nearly 30 miles an hour. Such steamships as the *Mauretania* are called "ocean greyhounds." They are the fastest and at the same time the largest ships which cross the ocean.

Of course, smaller boats which are built especially for speed make better time. For example, the United States destroyer *Cole* made $43\frac{3}{4}$ miles

per hour on her trial sea trip. In 1921 the motor-boat *Maple Leaf the 7th* made more than 80 miles an hour.

The speed of the fastest automobiles or motor-cycles cannot compare with that of the aëroplane. One aëroplane has gone at the rate of about $266\frac{1}{2}$ miles an hour.

In 1924 there was an interesting race from Brooklyn, Long Island, to Washington, D.C. This race was between an aëroplane and thirty carrier pigeons. The aëroplane and the pigeons left Long Island at the same time, each carrying messages to Washington officials. The aëroplane arrived at Washington 2 hours and 41 minutes ahead of the first pigeon. It is possible, of course, that the pigeons could have flown faster.

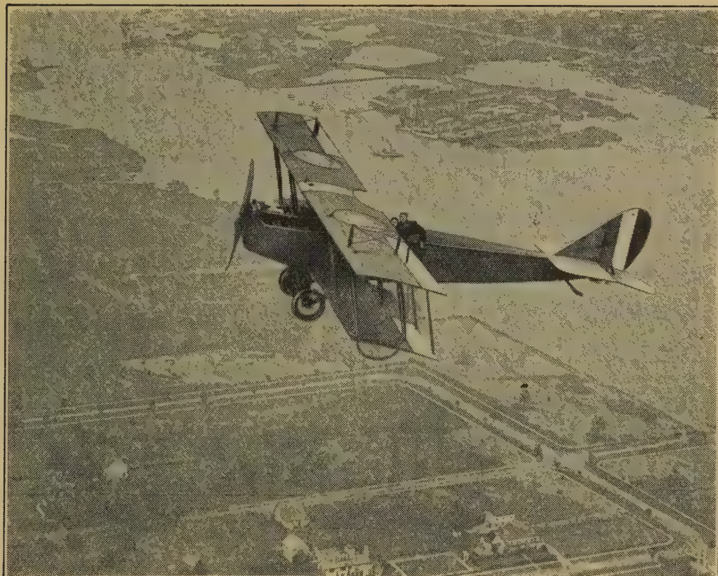
Because of the greater length of time they can stay in the air and the greater number of passengers which they can carry, dirigibles are thought by many people to be more likely to be used for travel than aëroplanes. The *ZR-3* left Friedrichshafen, Germany, on October 12, 1924, and landed at Lakehurst, New Jersey, on October 15. It carried 32 persons and 95,000 pounds of freight, including its fuel. The trip of 5066 miles was made at an average speed of about 62 miles

an hour. At one time the *ZR-3* was traveling at a height of 12,000 feet.

The speed of the automobile or the aëroplane can truly be said to be faster than the wind. Even in severe storms the wind rarely travels more than 80 miles an hour. The highest speed ever reported for the wind is 102 miles an hour. In many places in this country the wind has never been known to blow more than 60 miles an hour. On a calm day the wind does not blow more than one or two miles an hour. When the wind is blowing from 10 to 20 miles an hour we say we have a gale. Above 60 miles we say we have a storm, and above 70 miles, a hurricane.

However, even the speed of the fastest airship is a snail's pace compared to the speed at which sound travels. Sound travels more than one fifth of a mile a second. This is at the rate of nearly 800 miles an hour. The speed at which sound travels is again a snail's pace as compared with the speed at which light travels. Light travels at the rate of 186,600 miles a second.

The high speeds maintained by automobiles, by trains, and by aëroplanes mean, of course, much faster travel. This again means that distant places are within easier reach. High speed, therefore,



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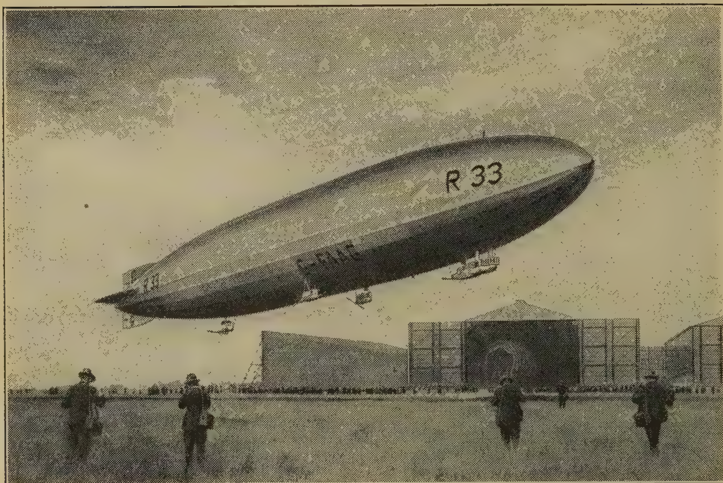
A UNITED STATES ARMY TRAINING PLANE FLYING OVER STAMFORD HARBOR

really has made the world smaller. At first it took years to sail around the earth. Magellan's ship started from Spain in 1519 and returned in 1521. Only fifty years ago a Frenchman wrote a book in which he described a voyage around the world in eighty days. This story was only imaginary, for at that time it was not possible to go around the world in so short a time, but even twenty-five years ago a person could make a trip



A DIRIGIBLE

around the world in forty days. Now it would be possible to make the trip in half that time. When traveling by aëroplane, it is possible to eat an early breakfast in New York and a late supper in San Francisco.

Such high speed creates a very serious problem. It is the problem of safety. Automobiles and railway trains and ships can now run faster than it is safe to ride. Accordingly, the large ocean liners now are being built for comfort and safety rather than for increases in speed. The fastest trains have cut down their speed, also. The automobile

speeder is being dealt with very severely. Only in the air is there an unobstructed speedway, where aëroplanes continue to race for higher speed. However, when we have many more aëroplanes, it will probably be necessary to restrict the speed of travel even in the air.

A SKIMMING EXERCISE

Skim to find the information needed to fill in the blanks. Write the answers on your paper.

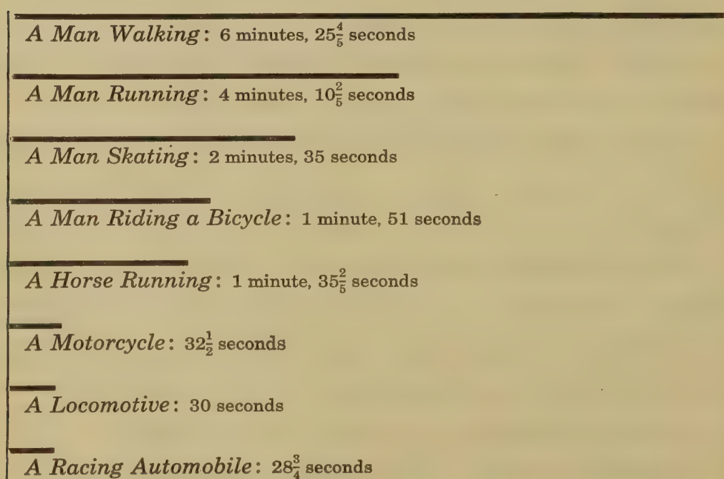
1. It took the champion swimmer ________ to swim a mile.
2. A clipper ship once traveled at the rate of ________ in an hour. This is (*faster? slower?*) than the champion walker.
3. The fastest average speed reported for an ocean greyhound is ________ an hour.
4. The motorboat *Maple Leaf the 7th* traveled nearly ________ *times* as fast as the destroyer *Cole*.
5. The fastest aëroplane traveled ________ an hour. This is ________ times as fast as the *ZR-3*.
6. When we say that there is a good breeze, the wind is blowing about ________ an hour.
7. Sound travels ________ in an hour.
8. Light travels ________ in a second.

MAKING GRAPHS TO COMPARE SPEEDS

1. Comparing speeds of traveling on land. These are the records for traveling 1 mile:

A man walking	6 min. $25\frac{4}{5}$ sec.
A man running	4 min. $10\frac{2}{5}$ sec.
A man skating	2 min. 35 sec.
Riding a bicycle	1 min. 51 sec.
A horse running	1 min. $35\frac{2}{5}$ sec.
A motor cycle	$32\frac{1}{2}$ sec.
A locomotive	30 sec.
A racing automobile	$28\frac{3}{4}$ sec.

This graph shows how we can compare these records of speed.



What is the fastest way of traveling on land? This is about 125 miles in an hour.

2. Comparing speeds of traveling on water and in the air.

Collect the records first. What are the record distances traveled in an hour?

A swimmer	(an average)	$2\frac{2}{3}$ mi. in 1 hour
A clipper ship		18 mi. in 1 hour

Fill in the records for these:

The *Mauretania*	A motor boat
A destroyer	An aëroplane
A dirigible	

To make the graph, draw a line on your paper 7 inches long. Mark it off into half-inch spaces. Now let each half inch stand for 20 miles.

The clipper ship went nearly 20 miles in an hour; it will have a line nearly as long as one of these spaces, or a half inch. Can you tell how many spaces each of the others should have?

What is the greatest rate of speed traveled on water? the greatest in the air?

3. Comparing record speeds on land, on water, and in the air with the speeds of the wind and air.

a. What makes the greatest speed on land? How many miles per hour has it made?

b. What makes the greatest speed on water? How many miles per hour has it made?

c. What makes the greatest speed in the air? How many miles per hour has it made?

d. How many miles per hour has the wind been known to blow?

e. How many miles per hour does sound travel?

Can you make a graph to show these compared rates of travel? If you make it on paper, use an inch for each hundred miles. If you make it on the blackboard, you might use two inches for a hundred miles.

How fast can man travel?

How can he do this?

Is this "as fast as the wind"?

What travels so much the fastest of all that we cannot include it in our graph?

MORE THINGS TO DO WITH THE SPEED LESSON

1. Find out what your speed is for running 50 yards. These are the records for boys and girls of eleven, twelve, and thirteen years of age for running 50 yards:

	11 Years	12 Years	13 Years
Girls	$8\frac{1}{5}$ sec.	8 sec.	8 sec.
Boys	8 sec.	$7\frac{3}{5}$ sec.	$7\frac{3}{5}$ sec.

How close to the record can you come?

2. Describe the speeds of travel of early days in running, walking, sailing, and in "flying about like comets" with the first steam locomotives.

3. Make one of these graphs and explain it.

a. Show the records for traveling 1 mile made by a train, a racing automobile, and a motor cycle. Which would beat in a mile race?

b. Show the records for running and skating 10 miles.

c. Show the record for walking 1 mile and the speed per mile of the first locomotive. If the man who made the walking record had been on the first locomotive, could he have saved time by walking?

d. Show the 1 mile running and pacing records of horses. Why is the running race the faster?

e. Show the record of the bicycle for traveling 1 mile, and the record of a bicycle traveling behind an automobile for 1 mile. How much time was saved by cutting a path through the air?

f. Show the records of a motor cycle and an automobile for traveling 100 miles. Can a motor cycle catch a racing car?

g. Show the records for swimming, walking, running, and skating 1 mile. Which is slowest?

h. Show the records of a steamship and a destroyer for traveling an hour. Can the steamship get away from the destroyer?

i. Show the records of an automobile and a motor boat for traveling an hour. Which is the faster way to travel?

j. Show the record of an aëroplane and a dirigible for traveling an hour. Is a dirigible good for racing?

WHAT DOES EACH PARAGRAPH TELL?

In the lesson you read some time ago about oil you learned a number of things: how petroleum was formed, where it was first found, how it is pumped, and many other things. Each one of the paragraphs in that lesson has one main topic. Each one tells one important thing about how oil and gasoline are obtained. If you understand the lesson you can tell what important topic each paragraph tells about.

Turn to the lesson on oil. The first paragraph tells what the whole article is about. You may list it in this way:

1. What this article is about.

Now do the same for each of the other paragraphs.

AN INDEX LESSON

Early in this book you found a lesson on the use of the index. Can you use the index of this book to find answers to the questions which are listed below? You will have to do these things:

1. Read the question and decide which is the important word to look for in the index.
2. Turn to the index and quickly locate the word.
3. Decide which page of the book will probably give the answer to the question.
4. Turn to the page and skim until you find the key word.
5. Read carefully to find the answer. If you do not find it, try another page listed in the index.

QUESTIONS

1. Who invented dynamite?
2. What qualities of bakelite make it useful?
3. What things cause spontaneous combustion?
4. Of what material were the clipper ships made?
5. How many letters were sent to the Dead-Letter Office in one recent year?
6. How did the discovery of the germ theory of disease affect modern health conditions?
7. Why is coal tar made in a closed oven?

INDEX DRILL WITH SERIES OF QUESTIONS

The questions on this page are grouped about three subjects. Use the index to find the answers.

1. What dyes did ancient Egyptians use?
2. How many coal-tar dyes are in common use?
3. For what other purpose, besides giving color, are coal-tar dyes used?
4. In what country are there large cochineal plantations today?
5. What part of dyewoods is shipped to market?

1. How much of our original forest area has been destroyed?
2. In what ways do insects harm the forests?
3. What products come from the long-leaf pine?
4. What are the duties of forest rangers?
5. How did the Forest Reserves get their name?
6. Where did the colonists first cut many trees?

1. Which is the more destructive — gasoline or dynamite?
2. What are the uses of gasoline?
3. Why does gasoline explode so quickly?
4. What is the difference between gasoline and petroleum?

Photograph by Ewing Galloway

AN ESKIMO CATCHING SEALS

WHAT THE ESKIMOS GET FROM SEALS[1]

[It is always interesting to know how people live in other lands — how they dress, what they eat, what kinds of homes they have, and how they

[1] Stefannson, Hunters of the Great North (Adapted).

succeed in being well and happy in the place in which they live. In the selection which follows, you will find some interesting and true things about how Eskimos live. They are told by Vilhjalmur Stefannson, the great American explorer, who went to live with the Eskimos in order to understand them better.

Read through the selection once to get an idea of what the Eskimos get from seals, and then when you have finished, read through once more and make an outline of it as you read.]

Some Eskimos make a living almost entirely by hunting seals, and I have had to do the same occasionally. The seal is the most useful of animals because it furnishes all you really need for living in comfort.

The lean and fat of the seal make together a diet upon which whole groups of Eskimos live in good health to a reasonably old age. On some of my later expeditions my white companions and I have lived entirely on seals for months at a time. Some people do not like the meat at first just because it differs considerably from any meat with which they are familiar; but you gradually get to like it. You may be dreadfully tired of

THE INTERIOR OF AN ESKIMO'S IGLOO. NOTICE THE SOAPSTONE KETTLE HANGING OVER THE SOAPSTONE DISH FULL OF BLUBBER

seal after three weeks, or even three months, but I never saw anyone who was tired of it after three years. It is in living with the Eskimos on seals as it is in living with the Chinese on rice, that no matter how much you dislike it at first, you are likely after a while to become as fond of it as they are themselves.

In addition to giving meat and fat for food, the seal furnishes fat for fuel. Many thousands of

© Ewing Galloway

LITTLE ESKIMO BOYS IN FURS, NOME, ALASKA

Eskimos have no other fuel in winter, and it serves them very well. They burn the fat in stone lamps made for the purpose. These are carefully trimmed and should not smoke. A woman is considered a very bad housekeeper if you can notice the smell of lamp smoke in her house or see stains of lamp soot on her hands, or on anything in the house. The first real Eskimo house

Photograph by Ewing Galloway

THE SUMMER TENT OF AN ESKIMO FAMILY

in which I lived usually had four seal oil lamps burning, keeping the temperature of the house, day and night, steadily betweeen 70° and 80°. We had a wood stove which we used for cooking only, but many Eskimos cook entirely over their lamps. This does very well, but takes a little longer than the wood stove.

Besides food and fuel, the seal furnishes clothing. The Eskimos use water boots in summer that are made entirely of sealskin, and in winter

IN THIS PICTURE YOU SEE BOTH THE LARGE UMIAKS AND THE SMALLER, FASTER KAYAKS

they use caribou-skin boots which in some cases have sealskin soles. Raincoats are made of sealskin and so are mittens, intended to be used in handling fish nets or anything that is wet. Coats and trousers for winter may be made of sealskin, but this is seldom done except when caribou is scarce.

All Eskimos, except some small groups that are very hard to reach, have for a long time bought canvas and other tents from traders. Sometimes a framework is made of bent willows and the canvas covering is thrown over this. But in the

old days this covering was made of skins — sometimes caribou, sometimes seal. Some Eskimos whom the traders do not reach with their trading wares still use skin tents, and they are of sealskin in districts where seals are more plentiful than caribou.

Lastly, sealskins furnish material for boats. The big Eskimo skin-boat called *umiak* is a large flat-bottomed boat from thirty to thirty-five feet long. It has a framework of spruce driftwood and is covered with the skins of seven bearded seals. The big seals are used for the *umiaks* and the small seals for the *kayaks*, smaller boats than the others. The entire *kayak* is closed in so that the waves can dash over it without getting into the boat. In the old days an Eskimo used to wear a waterproof shirt that was fastened tight around his neck, around his wrists, and around the mouth of the *kayak* in such a way that even if it capsized, no water could get into his boat.

EARLY AMERICAN METHODS OF TRANSPORTATION

[On your table this morning were foods which were not produced in your neighborhood. In your home are many things which were not made in your town. All these were carried, or transported, to your town and to your home, by railroad, by steamship, by canal boat, by auto-truck, or by some other part of our great transportation system. Perhaps you are planning a vacation trip to some distant part of our country. Whether you travel in a railroad coach, on a passenger boat, or by automobile over paved roads, you will be making use of some part of America's wonderful transportation system.

Today, when it is possible to draw on the whole world to supply our needs, and to travel with speed and comfort, we are likely to forget that there was a time in America when people had to do without things which could not be produced at home, and when a journey of fifty miles was a dangerous undertaking. Indeed, people who were going on a fifty-mile journey, made their wills before starting and parted from their friends with tears and with prayers for a safe journey.

In order to understand the great changes which have taken place in our methods of transportation since these early days in America, we must go back to the means of transportation used by the Indians who lived in the eastern part of what is now the United States when the first settlers came to make new homes in America. The Indians' ways of transportation were so well suited to this country of which the white men knew so little, that the American colonists immediately began to use some of these Indian methods.

The pages which follow tell many interesting things about how the Indians traveled and of what the colonists learned from the Indians about boats and trails. Read the lesson to find out as much as you can about these two questions:

1. *How did the American Indians travel and transport goods?*

2. *What Indian ways of transportation were used by the American colonists?*]

Travel was far more important among the Indians than transporting goods, for the Indians had few goods to ship. They carried on trade in such articles as stone, copper, and pipe-clay over considerable stretches of country, but these things

INDIANS LANDING TO MAKE A PORTAGE

were passed on from hand to hand; there were no peddlers who traveled over a long route. To carry on this trade, to hunt, and to make war on enemies, the Indians had developed two methods of transportation, — first, land transportation; second, water transportation.

When the Indians traveled they moved by water if their purpose made it possible. Most of eastern America, from the Atlantic Ocean to the Mississippi River, was covered with an almost unbroken forest — a forest of huge trees and thick under-

growth, very different from our open woods of today. To travel on land through such a thick forest and over rough ground is very hard. The best road through such a wilderness is a waterway because it is smooth and is already cleared from trees and undergrowth. And the vehicle for such a road is a boat of some sort.

The waterways of eastern America offered the Indians an excellent system of roads through the wilderness because there were so many of them; lakes and rivers were everywhere. The boats in which the Indians traveled could be used in very shallow water, and many of them were so light that it was easy to make a portage; that is, to carry the boat overland from one stream to another or around rapids. The country was so thoroughly cut up by streams, lakes, and other bodies of water deep enough for such boats that long journeys could be made with only an occasional portage. Most of what deserves the name of transportation among the Indians was water transportation.

The Indians used two very different types of canoes. One was made from a log of suitable size, and the other from the bark of trees, especially the birch, spruce, or elm. To make a canoe from a log, the Indian chose a section of trunk

INDIANS MAKING LOG CANOES

from fifteen to thirty feet long and three feet thick, which he hollowed out by fire and the stone ax, or adz. This type of canoe was called a "dug-out." The dugout was strong and serviceable, but heavy and slow moving. It could be used only on lakes or single rivers, and was never taken overland from one water to another.

To make a birch-bark canoe, the Indian selected his tree, made a straight, vertical cut in the bark from near the bottom of the trunk to a spot at

INDIANS BUILDING BIRCH-BARK CANOES

the height of his head, and then with great care peeled the bark from the tree by the aid of his knife. These strips of bark were sewed together with the long, tough, slender, fibrous roots of the larch or balsam tree. This bark covering was skillfully cut and shaped to the necessary pattern, and fastened with the same roots to a framework of light spruce wood. Hot pitch from the spruce or balsam tree was then spread on all seams and cracks to make the canoe water-tight. Each tribe

had its own pattern or style for its birch-bark canoes, which varied in length from ten to sixty feet. In this graceful boat, which rode the water lightly as a cork, and which he could carry easily upon his head, the Indian braved all kinds of waters, shooting the rapids of swiftly flowing rivers and riding the waves of the Great Lakes. Under his skillful guidance, the canoe glided smoothly through the water, but the white man was liable to get ducked a few times in his first attempts to handle a bark canoe.

Which of these two types of canoe was used, depended upon the following things: first, upon the kind of water in which the canoe was to be used; second, upon the number of portages to be made; third, upon the abundance of the birch tree; and fourth, upon how fast the traveler wished to go. In the Great Lakes region and in New England, where birch trees were plentiful, and where the many rapids and portages made a light craft desirable, the bark canoe was most used. In the South, especially in the region of the Gulf of Mexico, where there were no birch trees, and where fewer portages were necessary, the dugout was used.

The American colonists used both the bark

AN INDIAN TRAIL THROUGH THE FOREST

canoe and the dugout, but the white men had so many unfortunate experiences in trying to balance the bark canoe that the dugout came to be the more generally used. As the population increased, so great was the demand for logs suitable for canoe-making that in Massachusetts Bay and Plymouth Colonies such logs were marked by

the authorities and their use for any other purpose forbidden.

For their land travel, the Indians made paths, called trails. These trails followed the shortest practical routes. Many of them were first made by deer or buffalo as they went from one feeding ground to another, or as they searched for water or for salt licks. The Indian trails led to the best crossing places over streams, they led through the lower passes in the mountains, and they avoided marshes and steep slopes. In fact, these routes were the natural highways of the country. Whenever possible, the trails clung to high ground, following the tops of hills, from which the water was most quickly shed, where there was least underbrush, and where there were few streams to be crossed. The high ground, too, was windswept of snow in winter, and suffered least from forest fires.

Before the white man came, the most important trails led to the country of enemies and to hunting grounds. After the white man came, the trails most used led to the nearest trading posts and to the forts of the white man.

An Indian trail was only a narrow path from twelve to eighteen inches wide, for the Indians

always traveled single file. It often lay a foot or two below the level of the surrounding ground, beaten down by the many feet that passed over it. The Indian did little or nothing to improve the bed of his trail. Trees and bushes grew close on each side, and it was generally impossible to see ahead more than a rod or two. After a rain the water from the branches often drenched the traveler to the skin, while a single windstorm could easily fill the narrow trail so that it was nearly impassable. If storms or floods did make the trail impassable, the Indian did not try to clear it, but merely broke open a new trail by continual use.

Streams were either forded or crossed on fallen logs. The fords were usually at the point where one stream flowed into another, for here bars of sand or of mud were always to be found. The Indian built no bridges, for the need of these came with wheeled vehicles, which were unknown to the Indian. In fact, the Indian had practically no land vehicles at all and no strong beasts of burden. Dogs were sometimes used to draw a rude sled for short distances, but practically all the burdens that were borne were for the back, and were partly held in place and steadied by a strap that passed over the forehead, called a "burden strap."

INDIAN CARRYING A PACK WITH BURDEN STRAP

After the white man introduced the horse from the Old World, the Indian used it as a pack animal, as did the whites. The only vehicle invented for the horse to draw was a sort of rude sledge, called a "travois." This was usually made of the tepee poles and tepee cover. The tepee poles, tied into two bundles, were lashed on either side of the horse and trailed along behind him, the ends bumping over the ground. The tepee cover was folded into a tight bundle and tied over

THE TRAVOIS

the poles behind the horse, thus forming a bed upon which baggage could be strapped, and upon which old people and children could ride.

The early American colonists found the country threaded with narrow trails. Since these trails were the natural highways of the country and so offered the best routes inland, the early settlers followed them on their hunting and exploring trips. In time, these narrow trails became widened into roads. As the settlers went farther and farther inland, the Indian trails westward became pioneer roads to the West, for each of these westward trails led to some river or lake of the Mississippi Valley. Later, these routes developed into the great highways of the country. Today, the routes of all the main Indian trails are occupied by important railway lines; in fact, practically the whole present-day system of transportation in America, east of the Mississippi River, follows these natural highways made by the Indians hundreds of years ago.

[Recall the important points bearing on each question. Look back at the lesson to see if you have forgotten any points. When ready to report, close your book and wait for the signal to begin the test.]

A TEST OF YOUR MEMORY OF MAIN POINTS

Test your memory of main points by writing the answers to the questions on the next page. Do not glance back at the selection as you work. Number your answers as the questions in the book are numbered. Use as few words as possible. The answer to the question below shows you how to write your answers in a few words.

1. For what three purposes did the Indians need to travel?

Notice how the answer to this question is written:

1. *a.* To trade
   b. To hunt
   c. To make war on enemies

If you come to a question you cannot answer, skip it and go on. Go back to it later. Remember that you are to answer from what you have found out in this selection, not from what you may have read elsewhere.

If you finish the test before your teacher calls "Time," wait quietly until the others have finished. You will have an opportunity to check the accuracy of your work with your classmates.

1. What were the two chief methods of transportation used by the Indians?

2. Which method did the Indians prefer to use?

Copy the form below on your paper just as it is here, and fill it in with the answers to questions 3, 4, and 5.

Canoe	Materials	Where Used
a.	*a.*	*a.*
b.	*b.*	*b.*

3. What two kinds of canoes were used by the Indians?

4. Of what materials was each canoe made?

5. In what part of the country was each most used?

6. How did the Indians usually carry goods on land?

7. What vehicles and what beasts of burden were not used by the Indians until after the white man came?

8. What Indian vehicles were used by the American colonists?

9. Why did Indian trails become pioneer roads to the West?

If you have finished the test, turn your paper over. Now skim through the lesson and find sentences to read in class to prove your answers.

HOW MANY OF THESE DETAILED QUESTIONS CAN YOU ANSWER?

If you can answer all these questions you have a very clear understanding of the problems which you read about in the lesson "Early American Methods of Transportation." Write your answers in brief outline form as you did in the test upon the main points. When you have answered all the questions you can, draw a line across your paper. Then go back through the lesson and find the answers you did not remember. Write these answers below the line.

1. For what two reasons is a waterway the best road through a wilderness?
2. In eastern America, waterways offered the Indians an excellent system of roads through the wilderness, for another reason. What was it?
3. Which kind of canoe was best for long journeys where many portages were necessary? Why?
4. What other reasons helped to decide which kind of canoe should be used?
5. Which kind of canoe was most used by the colonists? Why?
6. Over what kind of ground did the Indian make his trail, if possible? For what reasons?

7. *a.* To what two places did the most-used trails lead before the white man came?

b. To what two places did the most-used trails lead after the white man came?

8. How were streams crossed by the traveler on an Indian trail?

9. Why were Indian trails called the "natural highways" of the country?

10. How much work did the Indian do to improve his trail?

11. What present-day means of transportation follow the routes of Indian trails?

When you check your work with the class, prove answers about which there is disagreement by reading sentences from the book as you did in the test upon the main points.

A TEST OF YOUR ABILITY TO EXPLAIN CLEARLY HOW SOMETHING IS MADE

Prepare to tell in detail how the Indian made one of the following vehicles:

1. The dugout.
2. The birch-bark canoe.
3. The travois.

FINDING THE MEANINGS OF WORDS

In the jungles of the Amazon River in South America live the warrior ants, which capture live creatures for food. They are as fierce as tigers, and all the creatures of the jungle flee before them. Great armies of these ants go out to hunt in long columns which spread out across the country, driving animals and insects before them.

These savage ants keep slaves. They attack colonies of smaller ants, drive them from their nests, and carry off their eggs and young as well as their stores of food. The captured eggs are carefully tended, and when these grow into ants they are made to work for their captors.

The lesson which follows tells of a drive of army ants across the jungle. There are some words the meaning of which you may not know, but you will not want to miss the story because of these words. Your dictionary will tell you the meaning of the hard words so that you can understand the story.

The sentences containing these words are given on the next page. Some of the sentences contain more than one hard word.

A word may have several meanings; therefore

your dictionary will probably give more than one meaning for most of these words. It is important to choose the meaning which fits the word as it is used in the sentence you wish to understand.

First read the sentence. Then look up the word in your dictionary. Read the definitions carefully and choose the one which seems to be the meaning of the word as it is used in the sentence. Now read the sentence again and see if you can put the meaning you chose in place of the hard word. The two sentences below show how to do this.

1. A *horde* of army ants had made their drive directly across the *glade*.

2. *A great number* of army ants had made their drive directly across *an open space in the forest*.

Do not write the sentences, but write the hard words with the definition you choose for each. This is the way to write the words used in the example above:

horde, a great number
glade, an open space in the forest

Now choose a definition for each of the hard words in the following sentences. You may be able to tell the meanings of some of these words from the way they are used in the sentences.

1. Number five was one of the series of holes dug along the Convict Trail to entrap *unwary* walkers of the night.

2. It was dug wide and deep on the edge of an *ancient dune* of pure white sand.

3. Day after day the pit had entrapped big beetles, rarely a mouse of some unknown *species*, more frequently a frog.

4. But the sudden leap of a bulldog, and the corresponding *vicious* attack of these ants, is particularly *appalling*.

5. I saw a soldier leap a full inch and a half toward the landing thud of the frog and bite and sting at the instant of *contact*.

6. He was a rough old chap, covered with warts, dark gray in color, with *mottlings* of chocolate and dull red and occasional glints of gold.

7. He had settled on the very line of traffic of the deadly foe, after *intrenching* himself and calling to his aid all the defenses which nature had given him.

8. And he was winning out — the first *vertebrate* I have ever known to withstand the army ants.

9. His sides would *vibrate* as he breathed with feverish rapidity.

10. Then two or three ants would run toward him and play upon him with their *antennæ.*

11. Even when a soldier sank his *mandibles* deep into the roughened skin and *wrenched* viciously, the toad never moved.

12. Once, when three bit him *simultaneously,* he *winced.*

13. Even this single eye is a *sham,* for its *optic* nerve dies out before the brain is reached.

14. With this handicap in mind, the *achievements* of these little creatures took on a still greater *significance.*

15. One *climax* of *mutual assistance* occurred near the rim of the pit on a level with my eyes, where one column passed over a surface which had been *undermined* by heavy rain.

16. I watched the overcoming of this *obstacle.*

17. I was astonished to see that as the length and weight of the dangling chain increased, the *base* support was *correspondingly* strengthened.

18. A mat of ants — spread out like *animated guy-ropes.*

19. Before the rim of the pit was reached, the chain had become a hollow tube of ants, all with heads inward, and through this *organic* shaft passed the *host* from the ascending column.

Photograph by Ewing Galloway

WITH ARMY ANTS "SOMEWHERE" IN THE JUNGLE[1]

PART I. IN THE PIT

[Now that you have cleared the troublesome words out of the way, you will enjoy reading this lesson about army ants. The Convict Trail spoken

[1] William Beebe, Jungle Peace (Adapted).

of in the first line was a path cut through the dense jungle by convict labor. You can see from the picture on page 365 that it would be necessary to cut a path in order to pass through such a thick growth of vines and grass and trees. Along the Convict Trail Mr. Beebe had sunk a number of pits which served as traps.]

Number five was one of the series of holes dug along the Convict Trail to entrap unwary walkers of the night — walkers or hoppers, for frogs and toads of strange tropical sorts were the most frequent victims. It was dug wide and deep on the slope of an ancient dune of pure white sand, a dune deep hidden in the Guiana jungle. Day after day the pit had entrapped big beetles, rarely a mouse of some unknown species, more frequently a frog.

Now I stood on the brim, shocked at an unexpected sight. A horde of army ants had made their drive directly across the glade, and scores of fleeing insects and other creatures had fallen headlong into this deep pit.

My sympathy went out to a small, sandy-white frog who was making a brave fight for his life. The pit was alive with a host of the army ants,

and wherever the little frog hopped, some soldier or heavy-jawed worker soon found him and sank jaws into his soft skin. With frantic scratching the frog would brush it off and leap again, only to be again attacked. The most horrible thing about these ants is their leaping ability. The hop of a bird or the jump of a toad when going about their usual business of life, if we think of it at all, is only amusing. But the sudden leap of a bull-dog, and the corresponding vicious attack of these ants, is particularly appalling. I saw a soldier leap a full inch and a half toward the landing thud of the frog and bite and sting at the instant of contact. I did not dare go into the pit. No warm-blooded creature could have stood the torture for more than a few seconds. So I opened my umbrella and, reaching down, scooped up the sand-colored frog. A half-dozen ants came up in the umbrella, but I brushed them aside and tied up the tormented frog in my handkerchief.

My next glance into the pit showed a large toad, squatted on a small shelf of sand, close to the edge of a crowded column of ants. He was a rough old chap, covered with warts, dark gray in color, with mottlings of chocolate and dull red and occasional glints of gold. He was crouched

flat, with all his fingers and toes tucked in beneath him. His head was drawn in, his eyes closed, and all his exposed surface was sticky with his acid perspiration — the sweat of fear. He knew his danger — of that there was no doubt — and he was apparently aware of the fact that he could not escape. He had settled on the very line of traffic of the deadly foe, after intrenching himself and calling to his aid all the defenses which nature had given him. And he was winning out — the first vertebrate I have ever known to withstand the army ants. For a few minutes he would be let alone and his sides would vibrate as he breathed with feverish rapidity. Then two or three ants would run toward him, play upon him with their antennæ, and examine him suspiciously. During this time he was immovable. Even when a soldier sank his mandibles deep into the roughened skin and wrenched viciously, the toad never moved. He might have been a pebble embedded in sand. Once, when three bit him simultaneously, he winced, and the whitish, sharp juice oozed from the pores of his skin. Usually the ants were content with merely examining him. I left him when I saw that he was in no immediate danger.

I now flattened myself on an antless area at the edge of the pit and studied the field of battle. In another half-hour the great labor of carrying out the dead victims began. The pit was five feet deep, with perfectly straight sides, which at the rim had been gutted by the rain, so that they actually overhung. Yet the ants which had half-climbed, half-tumbled and rolled their way to the bottom after their victims, now set themselves to solving the problem of climbing these cliffs of loose, crumbling grains, dragging loads which, in most cases, were much heavier than themselves. Imagine a gang of men set to carrying bundles of one to two hundred pounds up perpendicular cliffs twelve hundred feet in height, and the task of the army ants is made more clear. So swiftly did they work and so constantly did they shift their methods of meeting and overcoming difficulties, that I felt as I used to feel when looking at a three-ring circus.

The frightened victims, even those having excellent eyesight and powerful flight, were blind with terror. Instead of directing their flight upward, they drove from side to side. Those whose leaps should have carried them out, simply kicked out blindly and brought up against the sandy walls.

Roughly I divided the ants into two classes, white-heads and black-heads. The latter were by far the more numerous and, as a rule, were smaller, with less powerful jaws. But this did not mean that the white-heads were all soldiers. Most of them indeed were the hardest workers. The smallest black-head laborers, only a little more than one fifth of an inch long, did their bit, flew like bull pups at any prey which showed signs of life, and staggered bravely along with any piece of loot which their short legs could straddle.

The white-heads, twice as large, were the strong men of the community, putting all their activity into the labor, shouldering, pushing, dragging, and lifting. These persons had powerful jaws, but jaws which were stout and scissor-edged.

The heads of all the ants bulged on each side like domes, and exactly in the center of each dome, looking like the jet-black head of a tiny pin, was a single eye. Even this single eye is a sham, for its optic nerve dies out before the brain is reached, so we come to the astonishing realization that these ants are totally blind. They carry on all their activities through the sense or senses to be found in those marvelous quivering antennæ.

With this handicap in mind, the achievements of these little creatures took on a still greater significance, and with renewed interest I again watched the scene in the pit. When the majority of the pit victims had been slain, the process of carrying them up to the surface began. The ants divided into five distinct columns of traffic which, inch by inch, fought for a footing up three of the four sides.

One climax of mutual assistance occurred near the rim of the pit on a level with my eyes, where one column passed over a surface which had been undermined by heavy rain, and which actually overhung. I watched the overcoming of this obstacle. All the ants which attempted to make their way up to this point lost their footing and rolled headlong to the bottom. At last, a single small worker won a path to the rim at the top. Around the edge of the pit innumerable ants were constantly running, trying, on their part, to find a way down. The single ant communicated at once with all which came past, and without hesitation a mass of the insects formed at this spot and began to work downward. This could be done only by clinging one to another; but more and more clambered down this living ladder, until it

swayed far out over the vastness of the pit, three inches in length. I had never lost sight of the small worker, who had turned on his tracks and was now near the bottom of the ladder, reaching wildly out for some support — ant, grass, or sand. I was astonished to see that, as the length and weight of the dangling chain increased, the base support was correspondingly strengthened. Ant after ant settled itself firmly on the sand at the top, until a mat of insects had been formed, spread out like animated guy-ropes.

At last one ant in the rope touched the upraised jaws of the soldier far below. The contact acted like an electric shock. The farthest ant in the guy-rope gang quivered with emotion, one crowd of ants climbed down and another up, and bits of insect and spider prey began to appear from the depths of the pit, over the living carpet suspended from the brim. For an inch the ants climbed over the bodies braced against the cliff. Then, where the surface became smooth, the dangling chain came into use. Before the rim of the pit was reached, the chain had become a hollow tube of ants, all with heads inward, and through this organic shaft passed the host from the ascending column.

CHOOSING WORDS FOR DICTIONARY STUDY

Before you began to read Part I of "With Army Ants 'Somewhere' in the Jungle," you were asked to find meanings for a number of words. Perhaps you already knew what some of these words mean. When someone else chooses the words in a lesson for you to look up in the dictionary, it often happens that you are asked to find definitions for words whose meaning you know. It is hard for anyone else to decide which words in a lesson you need to look up in a dictionary in order to understand the lesson. You should decide that for yourself.

In Part II of "With Army Ants 'Somewhere' in the Jungle" there are a few words which may prevent you from understanding the story. When you come to one of these words in the lesson find its meaning in your dictionary. Be sure to choose a meaning which fits into the sentence you wish to understand.

WITH ARMY ANTS "SOMEWHERE" IN THE JUNGLE

PART II. ON THE TRAIL

There are many ludicrous sights to be seen in the ranks of army ants. Along a tree-trunk came three big white-heads straddling an inch-worm — in this case an inch-and-a-half-worm. They leaned forward and downward, the heads of those behind overlapping the abdomens in front, and they looked for all the world like the riders of an old-fashioned three-seated bicycle, spurting along the trail. After a hard fight, in the course of which I was stung twice, I unseated the trio and took the measuring worm away from them. As I lifted it from where it had fallen, at least fifty ants hurled themselves at the spot, jaws snapping, trembling with violent rage. I walked ten feet away and dropped the worm in the midst of another column, and within an equal number of seconds three new white-heads had mounted it and were hustling it along — the replicas in appearance and method of the first team.

In one place the army column made a slight detour round a hillock of sand grains upon which

a host of tiny brown ants was laboring. I thought it remarkable that such immunity should be given these dwarfs, and I sought the reason. It was forthcoming at once when I gingerly lifted a big soldier with the forceps and dropped him on the ant-hill. What occurred was a replica of the usual army ant scene, but enacted as if viewed through the large end of an opera-glass. Scores of the minute brown chaps rushed forth and for a moment fairly overbore the white-headed giant. Indeed, before he could recover he was dragged partly down a sandy hole. His jaws brandished and champed, but his assailants were so small that they slipped through them unharmed. Many actually seized the jaws themselves and were hurled through the air as they snapped together. Regaining his feet, the great army ant staggered off and, fortunately for him, rolled down a slope into another column of his own kind. Here he freed himself little by little, scraping off the minute fighting browns with the help of two very small workers, whose jaws, being much less in size, were better able to grip the diminutive furies.

A species of silvery-gray ant which was abundant in the glade was an object of special enmity, and even after one of these was killed and being

carried along, passing army ants would rush up and give it a vicious, unnecessary nip. One such ant made its escape from the hold of a small worker; but before it had taken ten steps it was actually buried under a rolling mass of army ants. The flying leap with which these athletes made their tackle would delight the heart of any football coach, although their succeeding activities belong rather to savage warfare.

As dusk began to settle down, I found a column of ants which must have discovered and sacked the city of some stranger ants. They were laden with ant-booty: eggs, larvæ, and dead ants by the hundred. This was comprehensible, but what I did not at first understand was a dense line of ants moving solidly in one direction, all laden with large eggs and young ants, which they were carrying with great care. A large number of the huge soldiers patrolled the outer flanks of the column, more than I had seen with all the other traffic lines together. I realized at last that I was looking at an actual moving of a portion of the army ant household itself. It was guarded and transported with all the care of which these insects were capable. The infant ants rested safely in the great jaws, the same jaws which all day had

been busy slashing and biting and tearing, and carrying food for these same infants.

And now the tropical night began to close down and I made my way back to the sand pit. The last of the columns was making its way out. I jumped down into the pit. The great gold-spotted toad stretched and scratched himself, looked at me, and trembled his throat. I was not an army ant!

I looked out and saw the last of the mighty army disappearing into the undergrowth. I listened and heard no chirp of cricket, nor voice of any insect in the glade. The silence was significant of wholesale death. Only at my feet two ants still moved, a small worker and a great white-headed soldier. Both had been badly disabled in the struggles in the pit, and now vainly sought to climb even the first step of the lofty cliff. They had been pitilessly deserted. As the last twilight of day dimmed, I saw the two still bravely striving, and now the toad was watching them intently.

TEST

If you looked up the meaning of all the words which kept you from understanding the story, you should be able to give a good definition for each of the following words. Write these definitions on a sheet of paper. Before you write the definition for a word, skim through the lesson until you find the sentence in which the word is used. Be sure that your definition fits the word as it is used in this sentence.

If there are any words for which you cannot give a clear definition, turn your paper over and write these words on the other side of the sheet. Then find a meaning for each of these words in your dictionary and write this meaning after each word.

ludicrous	diminutive
replicas	furies
immunity	wholesale
forceps	succeeding
minute	sacked
brandished	comprehensible
assailants	significant

THE BIRDS' WORST ENEMY

PART I

In nearly every civilized country thoughtful people are trying to protect birds. Almost every state in our country has laws prohibiting the killing of certain birds. Intelligent people are trying to protect birds, not only because it makes us happy to have birds near us, but also because we have learned how much they help us by eating injurious insects and animals.

But if we are to encourage and protect the birds, we must know what their enemies are. What do you think are some of the worst enemies of birds? You may think at once of one or two of the hawks that kill birds, of weasels, of snakes, of cats, of dogs, of men with guns, or even of boys with air rifles. Can you think of other bird enemies? Which of these enemies destroys the most birds? Read this lesson and decide for yourself whether or not the cat is one of the greatest enemies of birds.

Even those who love cats and keep them for pets admit that most cats kill birds. There is nothing strange about this habit of the cat. All

of the cat family — the tiger, the leopard, the mountain lion, the bobcat, the lynx, and the house cat — are hunters and meat eaters. And although the house cat has been domesticated for many hundred of years, it has never lost its wild habit of hunting for its food. Even cats that are given plenty to eat by their owners still like to hunt. The earliest domestic cats that we know anything about killed birds, and the tamest pet cat of today will kill them.

The first domestic cats of which we have any records lived in Egypt. There were domestic cats in that country at least fifteen hundred years before the birth of Christ. There are many early pictures of cats. It is interesting that these pictures show the cat catching birds, but do not show it catching rats or mice. One old Egyptian painting shows a cat seizing a duck by the wing, while holding one bird in her fore paws and another in her hind paws.

Cats were also known as bird killers in ancient Greece and in ancient Italy. The pictures on the opposite page are drawn from old mosaics in the museum at Naples, Italy. The one at the left shows a cat catching a bird. The one at the right shows a cat stalking birds at a fountain.

We do not know when cats were first taken into France and England. An English writer, who died in 1526, wrote a poem calling for vengeance on the whole race of cats, because they had killed his pet bird. Notice the queer old spelling in the following lines of his poem:

> That vengeance I aske and crye
> By way of exclamacyon
> On all the whole nacyon
> Of cattes wild and tame
> God send them sorrowe and shame
> That cat especyally
> That slew so cruelly
> My lytell pretty sparrowe
> That I brought up at Carowe.

In ancient Egypt, Greece, and Rome, and even in England at the time this poem was written,

people had not learned to study nature carefully. The examples just given merely show that the cat was recognized as a bird killer.

DICTIONARY LESSON

In the lesson you have just read you may have found some expressions hard to understand. Decide which word in each of the expressions given below is puzzling; look that word up in your dictionary; explain the expression in your own words.

a civilized country
laws which prohibit the killing of birds
injurious insects
Weasels kill birds
a domesticated animal
domestic cats
old mosaics
a cat stalking birds
a call for vengeance

THE BIRDS' WORST ENEMY

Part II

Today, however, the cat has been studied very carefully, not only by those who are interested in learning about birds, but also by those who are interested in learning about cats. The opinions of those who have studied the protection of birds as well as the opinions of those who have studied cats have been collected by Edward Howe Forbush, State Ornithologist of Massachusetts. An ornithologist is a person who studies about birds. Some of these opinions are given in this lesson. Read them and decide for yourself whether or not the cat is the birds' worst enemy.

Mr. T. W. Burgess, whose "Bedtime Stories" so many children have enjoyed, states that although the dearest pet he ever owned was a cat, he is beginning to see that this pet kills more birds than all other bird enemies combined. He says that, one summer, weeks of watching and planning for photographs of birds at home were wasted because the nests of three pairs of robins, one of bluebirds, one of kingbirds, and one of chipping sparrows in the orchard were emptied of their young by cats.

Dr. C. W. Townsend, Director of the New York Aquarium, writes that six nests of young birds of various kinds were destroyed on his place in one year by neighbors' cats.

Mr. A. C. Dyke watched one pet cat as carefully as possible for one season. This cat was known to kill fifty-eight birds during the season and undoubtedly killed many more.

Dr. Anne Perkins, of the state of New York, says that she has seen an active mother cat in one season devour the contents of almost every robin's nest in an orchard, even when tar, chicken wire, and other things were placed on the trunks of the trees to keep the cats away.

Dr. C. F. Hodge, author of "Nature Study and Life," and an authority on the raising of game birds, says that proof from all civilized countries which are trying to protect game birds and birds that eat insects shows beyond a doubt that the cat is the worst enemy of bird life.

Mr. Witmer Stone, editor of a magazine on birds, and a great ornithologist, says that there is no doubt that for years past the worst enemy of our smaller song and insect-eating birds has been the cat.

John Burroughs says that cats probably destroy

more birds than all other animals combined. He believes that if we are to keep birds we cannot keep cats.

Dr. Frank M. Chapman, of the American Museum of Natural History, author of important books on American ornithology and editor of the magazine *Bird-Lore*, has this to say on the subject:

> The most important problem in protecting birds is to find a way to dispose of the surplus cat population of this country. By surplus cat population we mean that very large number of cats which do not receive the care due an animal, and which, therefore, have to depend on their own efforts for food.

Mr. Henry W. Henshaw, of the United States Department of Agriculture, says that one of the worst foes of our native birds is the house cat. Probably none of our native wild animals destroy so many birds on the farm, particularly the young birds, as do cats.

Mrs. Davenport, who lives in Vermont, has taken great pains to teach cats not to kill birds. She did not succeed. She says that her cats brought in all kinds of low-nesting birds. One cat brought in three or four birds a day.

Dr. William T. Hornaday, director of the New York Zoölogical Park, has written a great deal

about the protection of wild life. He says that in such thickly settled communities as our Northern states the domestic cat is probably the greatest four-footed enemy of bird life. Thousands of persons who never have seen a cat hunt birds will doubt this statement, but proof of its truthfulness is plentiful. That cats destroy every year in the United States several millions of very valuable birds seems fairly beyond question. He believes that in settled regions they are worse than weasels, foxes, skunks, and mink combined, because there are about one hundred times as many of them, and those that hunt are not afraid to hunt in the daytime. He says that while not all cats hunt wild game, he believes that fully one half of them do.

Mr. T. Gilbert Pearson, secretary of the National Association of Audubon Societies, has written a great deal about birds. He says that there is no wild bird or animal in the United States that compares with the cat in the destruction of our birds.

Mr. Ernest Harold Baynes, author of "Wild Bird Guests," thinks that the cat is "far and away" the most destructive of all the animals for which man is more or less responsible.

Mrs. Mabel Osgood Wright, president of the Connecticut Audubon Society, and author of many popular books on birds, writes that if the people of the country insist upon keeping as many cats as they do now, all the good work that has been done to protect birds, and all the loving care of individuals in watching and feeding, will not be able to save our native birds in many places.

Mr. Forbush thinks that farm cats kill about 700,000 birds each year in Massachusetts. Dr. Field thinks that in the same state stray cats kill 2,000,000 birds each year. Dr. Fisher thinks that cats kill 3,500,000 birds each year in New York. Mr. Pratt thinks that the farm cats in Illinois kill more than 2,500,000 birds each year.

These statements are made by those who know most not only about birds, but also about cats. Therefore, those who love birds as well as those who love cats must think what to do about this problem. The next lesson will help you to decide what you think should be done.

FINDING MATCHING STATEMENTS

In the lesson you have just read, you found a number of different statements by bird-lovers proving in different ways that cats are enemies of birds. The statements given below tell some of the same things, but in different words. For each of the following statements find in the reading lesson just before this a statement which means exactly the same thing.

Read statement number 1 below.

In the second paragraph of "The Birds' Worst Enemy," Part II, we find: "this pet kills more birds than all other bird enemies combined." This means exactly the same as statement number 1. Copy it on your paper this way:

1. This pet kills more birds than all other bird enemies combined. Page 383, paragraph 2.

Now read statement number 2 and do the same thing with it. Try to find the matching statement for each one in this list.

1. All the other enemies together do not destroy so many birds as cats do.
2. Cats are bound to reach birds' nests even though things are put around the tree trunks to keep them down.

3. Cats destroy our songsters.

4. The preservation of birds means the non-preservation of cats.

5. Dr. Chapman thinks that the cats which are not well taken care of at home are the biggest enemies to birds.

6. The wild animals of our country do not kill so many farm birds as cats do.

7. There are two reasons why cats are more dangerous to birds than wild animals are: first, there are more of them; and, second, cats hunt both day and night.

8. No other bird or animal does so much damage to bird life as does the cat.

9. No other domestic animal is so great an enemy to birds as is the cat.

10. All the work done so far will not be successful in saving the birds unless we see to it that fewer cats are kept.

HOW TO KEEP CATS FROM KILLING BIRDS

The lesson you have just read shows clearly that if we can prevent cats from killing birds, we shall have more birds. How can this be done? Those who have studied the cat as an enemy to birds say that there are two things that must be done to solve this problem. The first is to find a way of doing away with stray cats. To do this all the people in the community must work together. The second is to learn how to keep pet cats from killing birds. Any person can do something to prevent cats from killing birds. This is something that any boy or girl can do.

DOING AWAY WITH STRAY CATS

Almost every neighborhood has a number of stray cats. Some of these cats do not belong to anyone. Others are so poorly fed by their owners that they wander far from home in search of food. Many cats seem to like to roam about rather than to stay in the homes of their owners. Some have been carried far away from home by owners who wanted to get rid of them. This is a cruel and cowardly thing to do. Almost every stray cat kills birds.

Many people believe that the best way to get rid of stray cats is to require a license for cats such as is required for dogs. This seems fair. There is no more reason for requiring licenses for dogs than for cats. If licenses were required, only people who cared enough for a cat to pay the tax would keep a cat. The cats with a license would be better fed and for that reason less likely to hunt birds. Stray cats could then be done away with in a way which would cause them as little suffering as possible.

One city now has a law that every cat in the city must have a license. Another city does not require a license, but makes each owner of a cat put a col-

lar or tag on it with the owner's name on the tag. If you live in a town or city, you may wish to talk over with your parents some plan of licensing or tagging cats. Perhaps they can ask the men and women who make the laws for your city to require cats to have licenses, or at least to have each pet cat wear a tag.

KEEPING PET CATS FROM KILLING BIRDS

Everyone who has a pet cat should do something to keep his cat from killing birds in the neighborhood. Boys and girls can help in this work as well as their parents. It does not seem possible to train most cats so that they will not catch birds. Other plans must therefore be used. Several such plans have been worked out by those who wish to keep a cat and yet do not want to have the birds killed.

The first of these plans is to feed the cat so well that it will not need to hunt for food. When a mother cat has kittens which are just beginning to eat meat, it is especially necessary to feed both the cat and the kittens. If this is not done, the mother will probably hunt food not only for herself but also for the kittens. A mother cat with

half-grown kittens is especially likely to hunt birds to feed them. Even well-fed cats, however, will sometimes hunt birds.

A second plan is to fasten bells on each cat so that the bells will jingle whenever the cat moves. This helps to prevent the cat from stealing up on birds, but it will not prevent the cat from catching some birds. Of course this plan does not protect helpless young birds.

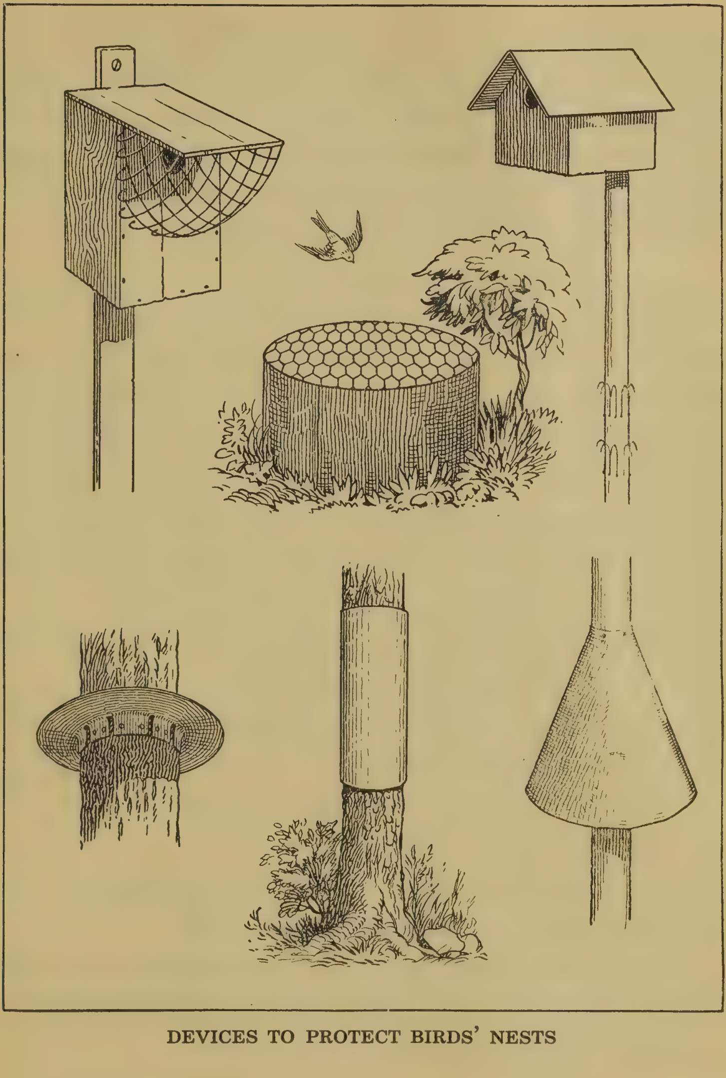
The cat shown in the picture above was a fine, sleek, pet Angora, with six bells on its collar.

It brought in thirty-two birds in one nesting season and twenty-two the next. In the picture it is shown in the act of killing a young catbird.

The third and best method is to keep cats away from the birds. Some people put a band around the trees where birds have nests and on posts which support bird houses so that the cats cannot climb to the nests. In winter the birds may be fed on platforms so high that the cat cannot reach them. There is no way, however, to protect birds which are on the ground or in bushes in neighbors' yards.

The only safe method therefore is to shut the cat up at times when birds are likely to be caught. It is important that cats should not be turned loose for the night, since they do their worst damage in the early morning when birds flock to the ground for their early feeding. It is quite common for a cat to kill the mother bird before she leaves her nest in the morning. If cats are turned out in the morning it should not be until late and then only *after* they have been fed a hearty breakfast.

Many owners keep their cats tethered or shut up during the birds' nesting season. Mr. Forbush tells one way to do this:



DEVICES TO PROTECT BIRDS' NESTS

A cat may be tethered to an overhead wire in pleasant weather by means of a line and a snap hook. This gives outdoor conditions, allows the cat to exercise by moving back and forth, and probably will prevent it from catching birds, except possibly such young as may flutter in its way. There should be a stop near each end of the wire so that the cat cannot climb or become entangled.

If you have a cat, you must remember that you must not only keep it from killing birds in your own yard, but also keep it from killing birds in your neighbor's yard. You have no more right to allow your cat to kill birds in your neighbor's yard than your neighbor would have to keep a vicious dog which would come into your yard and kill your cat.

If you own a cat, it is a good thing to ask yourself the following questions:

1. Do I keep my cat at home and give it a comfortable sleeping-place?

2. Do I feed my cat enough so that it does not have to hunt for food?

3. Do I shut my cat up at night so that it will not kill birds in the early morning?

4. Do I keep my cat shut up or tethered at times when it is likely to kill birds and especially in nesting season?

5. Does my cat wear a collar so that people will know that it is not a stray cat?

6. If my mother cat has kittens, do I make sure that these kittens will not become stray cats?

7. Do I plan for my cat so as to be sure that it is kept comfortable and happy without being a bird killer or a nuisance to neighbors?

EXERCISES

1. To be read aloud:

Each person who owns a cat should be able to answer "Yes" to each of the above questions. Read from the lesson to show why each separate answer should be "Yes."

2. To be done alone and on paper:

Make an outline of the lesson you have just read. What will the main heading be? Try to include only the necessary information in your outline.

HOW TO KEEP MAIL FROM BEING LOST

DO YOU KNOW

That 21,000,000 letters went to the dead-letter office in one recent year?

That 803,000 parcels did likewise?

That 100,000 letters go into the mail yearly in perfectly blank envelopes?

That $55,000 in cash is removed annually from misdirected envelopes?

That $12,000 in checks, drafts, and money orders never reached intended owners?

That Uncle Sam collects $92,000 a year in postage for the return of mail sent to the dead-letter office?

That it costs Uncle Sam $1,740,000 yearly to look up addresses on misdirected mail?

That 200,000,000 letters are given this service, and

That it costs in one city alone $500 daily?

"A great deal of unnecessary trouble and expense," you say, when you read the above figures. "How could people forget to put the address on an envelope, or be so careless as to put on the wrong address?" And, "What is the dead-letter office?"

INSIDE A BUSY POST OFFICE. THIS SHOWS THE MAIL BEING SORTED TO GO OUT ON DIFFERENT ROUTES

Into the post offices of our country pours every day a steady stream of over 30,000,000 letters and 7,000,000 parcel-post packages. Day and night the postal employees work at this huge task, sorting the mail and starting it on the right track toward its destination. First of all the letters are "faced up," that is, arranged with addresses running the same way so that they can be run through a machine which cancels the stamps as they pass. Those stamps which are not correctly placed in the upper right-hand corners of envelopes must be canceled by hand.

The next step is sorting the mail to be distributed to different places. The distributors work with lightning speed, deciding instantly into which channel a letter should go — north, south, east, or west. Some distributors can sort 35 letters a minute with a score of better than 99 per cent accuracy.

This sorting of the mail goes on very swiftly until a poorly addressed letter comes along. Then the postal employee, working at high speed, must stop and spend valuable time looking for some clue as to where it should go. Sometimes it is marked "Try ____," and is then sent out to a possible destination. Sometimes it is stamped "Address illegible" and returned to its sender. Sometimes it is turned over to a "hard" reader, who, because of his long practice, knowledge of geography, and good sense can usually read an address which would have no meaning to an ordinary person. He has all sorts of puzzling problems to solve.

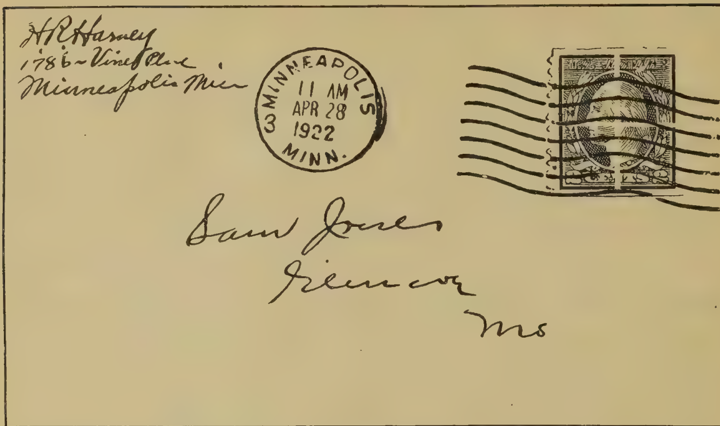
Many efforts must be made to deliver puzzling mail before it can be given up as impossible and sent to the Dead-Letter Office in Washington. Even at the Dead-Letter Office the troublesome mail cannot be destroyed. It is opened and exam-

ined very carefully for some clue as to where it should be sent. If the sender has written the destination clearly at the beginning of the letter, the message is put back into its own envelope, then into a large official envelope and forwarded, usually several months late, to the one for whom it was intended. If the writer has not given the destination, but has included his own address, the letter is returned to him, long after he supposes it has been delivered.

Last year the Post-Office Department reported that 21,000,000 letters went to the Dead-Letter Office and that 83,000 packages went through the same long troublesome process in reaching the people for whom they were intended. Why is it that all these letters and parcels go astray?

In the first place, of course, most of this mail is mis-sent or delayed because it is not correctly addressed. Sometimes no address at all is given. The Post-Office Department says about this: "Ask Uncle Sam anything in reason and he will deliver the goods, but don't ask him to guess the address of your correspondent."

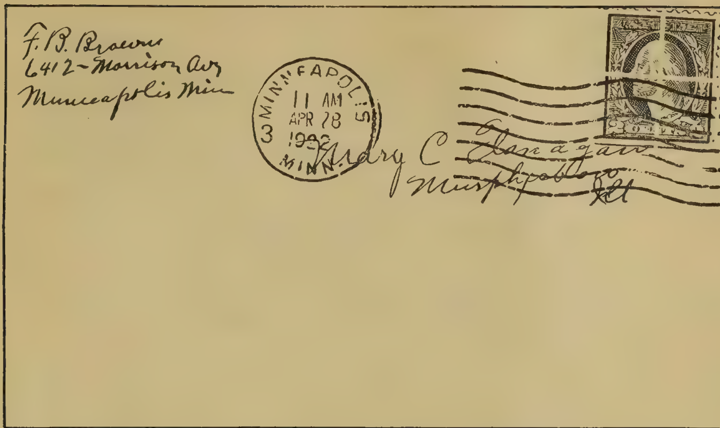
Many letters, too, are given the wrong address or do not carry enough address so that the postal employees can tell where they are to go. The



WHERE WOULD YOU SEND THIS LETTER? THERE IS A GLENCOE IN MISSOURI AND ONE IN MARYLAND

name of the person addressed, the street and number, or number of the rural route, and the name of the city and state should always be included in the address if it is possible. Uncle Sam says: "The man who mails a letter without proper address expects the impossible; Uncle Sam can't tell its destination by finger prints on the envelope."

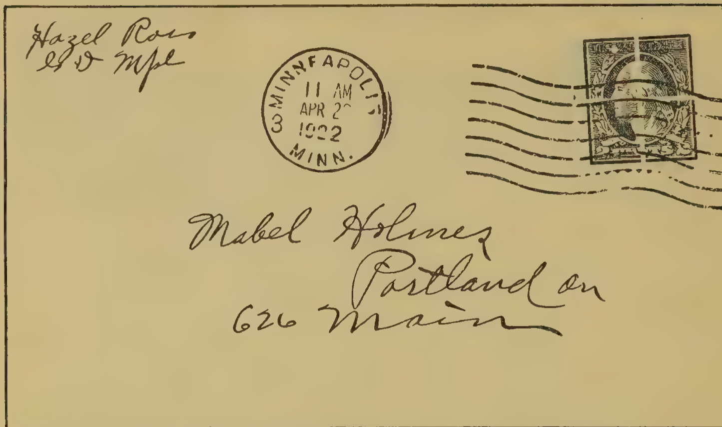
Sometimes a letter goes astray because its address is written poorly. If the writing is very poorly done, either with pencil, or with ink on an envelope of poor quality which blots easily, it is sometimes practically impossible to read the address. Abbreviations cause a great deal of



THIS ENVELOPE SHOWS WHAT HAPPENS WHEN THE ADDRESS IS NOT CORRECTLY PLACED

trouble. These pairs are particularly troublesome: Mo. and Md.; Colo. and Cal.; Miss. and Minn.; N.J. and N.Y.; Va. and Pa. In fact, abbreviations of states so often cause trouble that the Postal Department advises people not to use them at all on envelopes or packages, but to write out the name of the state in full. The illustration at the top of the preceding page shows how easily a mistake may occur because of poorly written abbreviations.

Another thing that makes an address hard to read is wrong spacing on the envelope. If the address is placed too high, the canceling machine



WHY WAS THIS LETTER SENT TO PORTLAND, MAINE?

may blur it. The letter at the top of page 403 shows how this is done.

It is important in addressing envelopes to keep the parts of the address in order. This is the right order:

Miss Helen Woods	(*Name*)
346 Pleasant Street	(*Street and number*)
Denver	(*City*)
Colorado	(*State*)

What is wrong with the address in the illustration at the top of the page?

But although wrong addresses cause a large share of the work of the Dead-Letter Office, most of this work could be saved if every piece of mail

carried the correct return address of the sender. Uncle Sam says: "Every man knows his own address if not that of his correspondent. PUT IT IN THE UPPER LEFT-HAND CORNER."

The postmaster in one of our large cities makes the following suggestion:

> Before you mail a letter, stop and look at it. Imagine that you have never heard of the person to whom it is going. Can you make out the name? If you were the postman, could you deliver it? Is there a return address? If you could not deliver the letter, could you return it? If you can answer "Yes" to these questions, the letter is ready to be mailed.

MEMORY TEST

As fast as you can, write on a sheet of paper a list of suggestions called "How to keep mail from being lost." You might start like this:

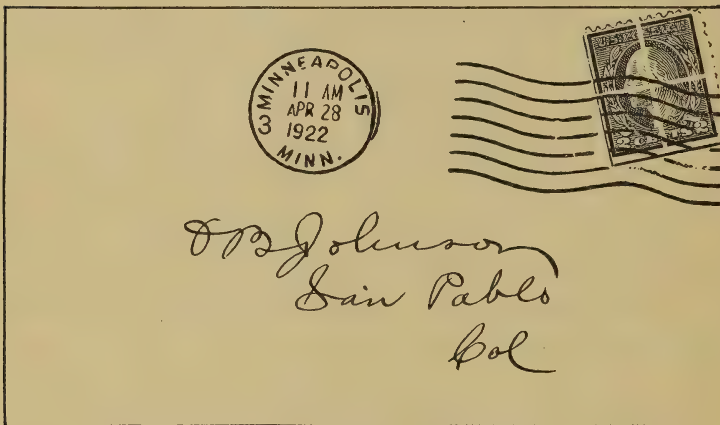
1. Write plainly.
2. Be sure you have put the right address on the envelope.

When you have finished, draw a line under what you have written and then go back through the lesson to see if you can find more suggestions to add to your list.

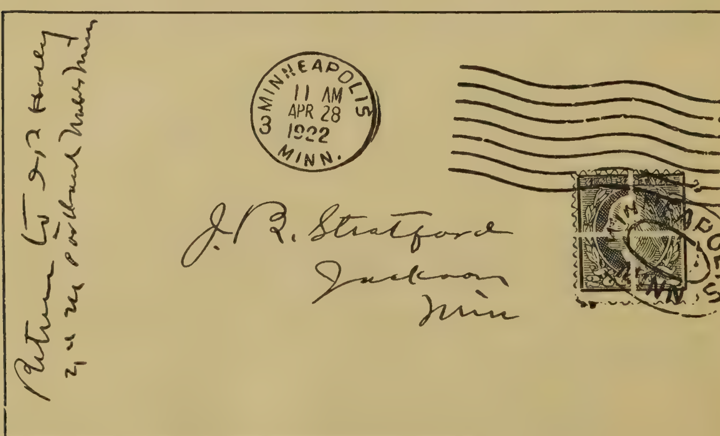
WHAT IS WRONG ON THESE ENVELOPES?

Write or tell what is wrong in each case.

1.



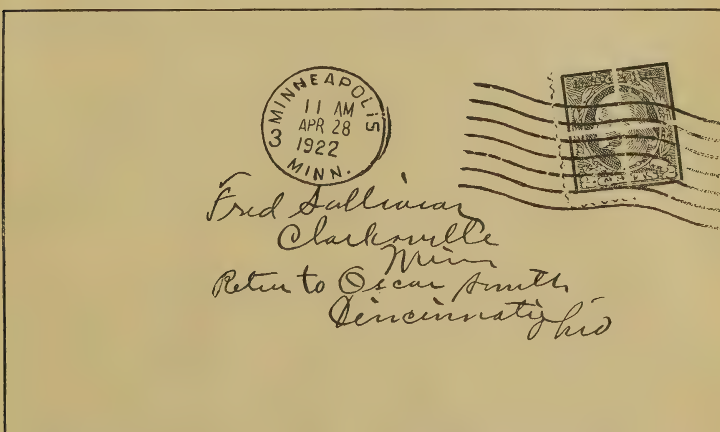
2.

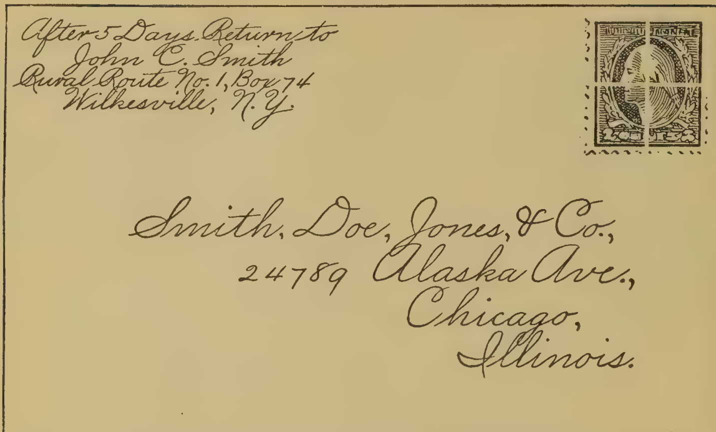


3.


MINNEAPOLIS
11 AM
APR 28
1922
3
MINN.

4.


MINNEAPOLIS
11 AM
APR 28
1922
3
MINN.
Fred Sullivan
Clarksville
Minn



AN ENVELOPE CORRECTLY ADDRESSED

HOW TO ADDRESS AN ENVELOPE CORRECTLY

The Post Office Department has given out a form of address which is plain and easy to read. It is the one at the top of this page. Using it as a model, address envelopes for the following letters:

1. A letter to your teacher from yourself.

2. A letter to Ginn and Company, 2301–2311 Prairie Avenue, Chicago, Illinois, from yourself.

3. A letter to yourself written by some friend of yours away from your own home.

4. A letter to The Nature Magazine, 1214 Sixteenth Street, Washington, D. C., from yourself.

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